

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner

IPR2023-00402
U.S. Patent No. 8,830,821

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. § 312 AND 37 C.F.R. § 42.104**

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PETITIONER’S EXHIBIT LIST

Ex.1001	U.S. Patent No. 8,830,821 to Cohn et al.
Ex.1002	Prosecution History of U.S. 8,830,821
Ex.1003	Declaration of Dr. Henry Houh under 37 C.F.R. § 1.68
Ex.1004	<i>Curriculum Vitae</i> of Dr. Houh
Ex.1005	U.S. Patent Publication No. 2004/0205239 to Doshi et al. (“Doshi”)
Ex.1006	“Definitive MPLS Network Designs,” by Guichard et al., Cisco Press, 2005 (“Guichard”)
Ex.1007	U.S. Patent Publication No. 2003/0117950 to Huang (“Huang”)
Ex.1008	“MATE: MPLS Adaptive Traffic Engineering” by Elwalid et al., IEEE, 2001
Ex.1009	“Traffic Engineering with MPLS,” by Osborne et al., Cisco Press, 2003
Ex.1010	“Fast Network Re-optimization Schemes for MPLS and Optical Networks” by Bhatia et al., 2006
Ex.1011	RFC3209
Ex.1012	Complaint, <i>Orckit Corporation v. Cisco Systems, Inc.</i> , Civil Action No. 2:22-cv-276-JRG-RSP (E.D. Tex, Jul. 22, 2022)
Ex.1013	Federal Court Statistics
Ex.1014	Proposed Docket Control Order, <i>Orckit Corporation v. Cisco Systems, Inc.</i> , Civil Action No. 2:22-cv-276-JRG-RSP (E.D. Tex, Dec. 2, 2022)
Ex.1015	Infringement Contentions, <i>Orckit Corporation v. Cisco Systems,</i>

	<i>Inc.</i> , Civil Action No. 2:22-cv-276-JRG-RSP (E.D. Tex, Nov. 3, 2022)
Ex.1016	U.S. Patent Publication No. 2008/0155257
Ex.1017	U.S. Patent No. 7,624,142
Ex.1018	U.S. Patent Publication No. 2006/0015781
Ex.1019	Definitive MPLS Network Designs Guichard, Copyright Public Record(s)
Ex.1020	Definitive MPLS Network Designs Guichard, Library of Congress Record(s)
Ex.1021	Internet Archive Affidavit, Definitive MPLS Network Designs (Guichard)
Ex.1022	RFC3272
Ex.1023	“Multiprotocol Label Switching (MPLS) Traffic Engineering,” Cisco IOS Release 12.0(5)
Ex.1024	IETF “Multiple Metrics for Traffic Engineering with IS-IS and OSPF,” Fedyk et al.
Ex.1025	U.S. Patent Publication No. 2011/0141877 to Xu et al., (“Xu”)
Ex.1026	U.S. Patent No. 5,699,403 to Ronnen (“Ronnen”)
Ex.1027	RFC2026
Ex.1028	U.S. Patent No. 8,102,774
Ex.1029	U.S. Patent Publication No. 2007/0201513
Ex.1030	RFC3469
Ex.1031	U.S. Patent No. 6,980,906

Ex.1032	U.S. Patent No. 7,502,884
Ex.1033	U.S. Patent No. 7,197,418
Ex.1034	U.S. Patent Publication No. 2006/0250948
Ex.1035	U.S. Patent Publication No. 2007/0047469
Ex.1036	U.S. Patent Publication No. 2006/0291391

I. INTRODUCTION

Pursuant to 35 U.S.C. §§ 311, 314(a), and 37 C.F.R. § 42.100, Cisco Systems, Inc. (“Petitioner”) respectfully requests that the Board review and cancel as unpatentable under (pre-AIA) 35 U.S.C. §103(a) claims 1-20 (the “Challenged Claims”) of U.S. Patent No. 8,830,821 (“’821 patent,” Ex.1001).

As shown below and confirmed in the Declaration of Dr. Houh (Ex.1003), the features recited in this patent were already known and would have been obvious to a POSITA. *See generally* Ex.1003. The references presented in this Petition render obvious the Challenged Claims, which should be canceled for unpatentability.

II. GROUNDS FOR STANDING

Petitioner certifies that the ’821 patent is eligible for IPR, and that Petitioner is not barred or estopped from requesting IPR challenging the patent claims. 37 C.F.R. § 42.104(a).

III. NOTE

Petitioner cites to exhibits’ original page numbers. Emphasis in quoted material has been added.

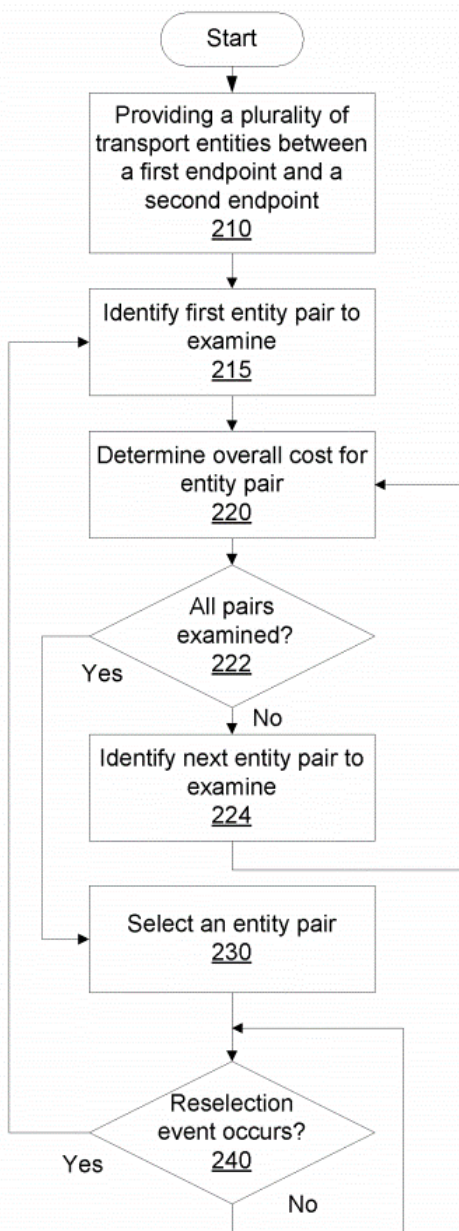
IV. SUMMARY OF THE '821 PATENT

A. Overview of the '821 patent

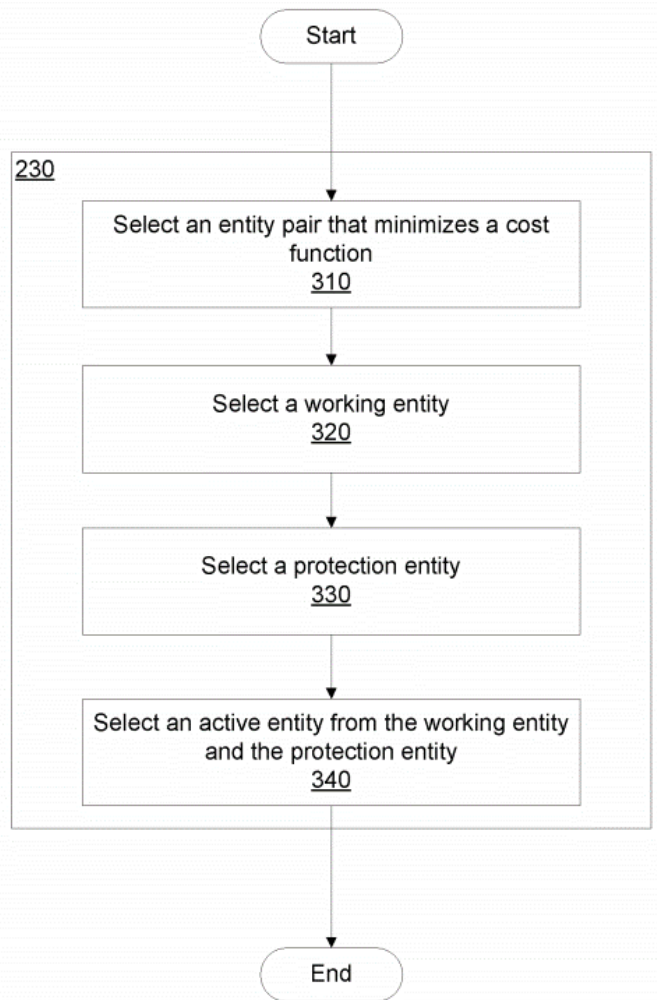
The '821 patent generally describes a “system and a method for selecting [Multiprotocol Label Switching] MPLS network transport entities between a first and a second endpoint.” Ex.1001, Abstract. According to the '821 patent, the noted system and method provide “protection against multiple span or node failures” by utilizing transport entity pairs that are “fully or partially resource disjoint.” Ex.1001, 3:15-18. “[A]n overall cost for each pair of the plurality of transport entities is determined” and a pair, comprising a “working entity” and a “protection entity,” is “selected to minimize an overall cost.” Ex.1001, 4:13:16, 29:33. For communication, “[a]n active entity may be selected from the working entity and the protection entity.” Ex.1001, 4:57-58; Ex.1003, ¶34.

The '821 patent also discloses that an “event” triggers “entity pair reselection.” Ex.1001, 4:34-35. The reselection may result in selecting new entity pair or selecting the same pair. Ex.1001, 4:63-5:8. The event trigger may be: a network operational status change, adding an entity, removing an entity, or cost changes for an entity. Ex.1001, 4:35-41; Ex.1003, ¶35.

Figures 2 and 3, reproduced below illustrate flow charts of the '821 patent's methods.



Ex.1001, Fig. 2.



Ex.1001, Fig. 3.

B. Prosecution History of the '821 patent

The '821 patent claims priority to Provisional application No. 61/499,943 filed on June 22, 2011.

In response to an Office Action, the Applicant amended independent claim 1 “to clarify” the “reselecting said entity pair” limitation, as shown below:

if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,

Ex.1002, 55, 64. Applicants then argued that the prior art does not teach the amended claim (among other features) because the asserted art only addresses failovers and not reselecting the path pair apart from failover. Ex.1002, 63. The patent issued on September 9, 2014. Ex.1002, 30; Ex.1003, ¶¶38-40.

V. LEVEL OF ORDINARY SKILL IN THE ART

A Person of Ordinary Skill in The Art (“POSITA”) on June 22, 2011, would have had a working knowledge of network communications and multiprotocol label switching (“MPLS”) techniques available at the time. A POSITA would have had a bachelor’s degree in computer science, computer engineering, electrical engineering, or equivalent training, and approximately two years of experience working in the field of network communications and been knowledgeable regarding MPLS techniques. Lack of professional experience can be remedied by additional education, and vice versa. Ex.1003, ¶¶27-29.

VI. CLAIM CONSTRUCTION

Claim terms in IPR are construed according to their “ordinary and customary

meaning” to those of skill in the art. 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). Petitioner submits that, for the purposes of this proceeding and the grounds presented herein, no claim term requires express construction. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). For clarity, however, Petitioner notes below example embodiments in the specification. Ex.1003, ¶¶41-43.

A. “entity”

Each independent claim of the ’821 patent recites an “entity.” The ’821 patent discloses that exemplary “MPLS-TP transport entities” include “label switch paths (LSPs) or pseudo wires (PWs).” Ex.1001, 3:22-29. Accordingly, the term “entity” includes an MPLS LSP or a PW. Ex.1003, ¶¶44-45.

VII. RELIEF REQUESTED AND THE REASONS FOR THE REQUESTED RELIEF

Petitioner asks that the Board institute a trial for *inter partes* review and cancel the Challenged Claims in view of the analysis below. Petitioner challenges all claims of the ’821 patent because they are all asserted in co-pending litigation. Finding the Challenged Claims unpatentable here will reduce the time and expense of ’821 patent litigation for all parties.

VIII. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

A. Challenged Claims and Statutory Grounds for Challenge¹

Grounds	Claims	Basis
#1	1-7, 9-11, 13, and 17-20	35 U.S.C. § 103 (Pre-AIA) over Doshi and Guichard
#2	8 and 12	35 U.S.C. § 103 (Pre-AIA) over Doshi, Guichard, and Huang
#3	14-16	35 U.S.C. § 103 (Pre-AIA) over Doshi, Guichard, and Xu

U.S. Patent Publication No. 2004/0205239 to Doshi (“Doshi,” Ex.1005) published on October 14, 2004.

The textbook “Definitive MPLS Network Designs,” by Guichard et al. (“Guichard,” Ex.1006) bears a copyright date of 2005, has an ISBN Number 1-58705-186-9, and states that it was published by Cisco Press in 2005. Ex.1006, 2; Ex.1021. In addition, Guichard was registered as a publication with the Copyright

¹ For each combination presented herein, Petitioner relies on the teachings, and not on a physical incorporation of elements. *See In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012); *In re Etter*, 756 F.2d 852, 859 (Fed. Cir. 1985); Ex.1003, ¶¶66, 213, 233.

Office in 2005, and the Library of Congress online catalog confirms that Guichard was published in 2005. Ex.1006, 2; Ex.1019; Ex.1020. Also, the Internet Archive, which is a well-known archiving website, captured on August 30, 2009 the website Amazon.com, showing that Guichard was available for purchase online and that two reviews were posted in 2005 and one review was posted in 2006, which further support public availability as of those dates. Ex.1021, 1-5. The totality of the evidence demonstrates that Guichard was publicly available to interested persons exercising reasonable diligence, and, therefore, was a printed publication as of 2005. *See Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29, at 17-18 (P.T.A.B. Dec. 20, 2018) (precedential); *CIM Maint. Inc. v. P&RO Sols. Grp., Inc.*, IPR2017-00516, Paper 8, 18–20 (P.T.A.B. June 22, 2017) (Amazon.com reviews show public availability); *Ex parte Ghalili*, Appeal No. 2020-001741 (P.T.A.B. August 3, 2020) (affirming reference as prior art that was web-archived prior to the effective filing date of the application).

U.S. Patent Publication No. 2003/0117950 to Huang (“Huang,” Ex.1007) published June 26, 2003.

U.S. Patent Publication No. 2011/0141877 to Xu (“Xu,” Ex.1025) was filed December 15, 2009, and issued in 2013.

Doshi, Guichard, and Huang are each prior art under 35 U.S.C. § 102(b). Xu

is prior art under 35 U.S.C. § 102(e).²

Petitioner also appropriately cites additional prior art as background knowledge of a POSITA and to provide contemporaneous context to support Petitioner’s assertions regarding what a POSITA would have understood from the prior art in the grounds. *See Yeda Research v. Mylan Pharm. Inc.*, 906 F.3d 1031, 1041-1042 (Fed. Cir. 2018) (affirming the use of “supporting evidence relied upon to support the challenge”); 37 C.F.R. §42.104(b); *see also K/S HIMPP v. Hear-Wear Techs., LLC*, 751 F.3d 1362, 1365-66 (Fed. Cir. 2014); *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1363 (Fed. Cir. 2016). For instance, Dr. Houh and this Petition cite to several “Request for Comments” (RFC) documents published by the Internet Engineering Task Force (IETF). To the extent the Board determines that these IETF documents must qualify as prior art “printed publications” for the purposes for which they are cited, the documents do so qualify. *See, e.g.*, Ex.1027, 6, (“RFCs can be obtained from a number of Internet hosts...”), 8 (IETF documents are “readily available to a wide audience”), 26 (IETF participants “shall publicly announce...every activity” relating to the standardization process);

² The ’821 patent was prosecuted as a pre-AIA application. Ex.1002, 34. Doshi, Guichard, Huang, and Xu would also be prior art under post-AIA 35 U.S.C. § 102(a).

Ex.1003, ¶¶46-47. The Board has repeatedly found IETF documents, including RFCs, to be “printed publications.” *See, e.g., Apple, Inc. v. VirnetX, Inc.*, IPR2017-00337, Paper 31, 46-47 (May 30, 2018) (RFCs are “precisely the type of documents whose main purpose is for public disclosure”); *Riot Games, Inc. v. Paltalk Holdings, Inc.*, IPR2018-00130, Paper 11, 30-33 (May 15, 2018) (RFCs are printed publications).

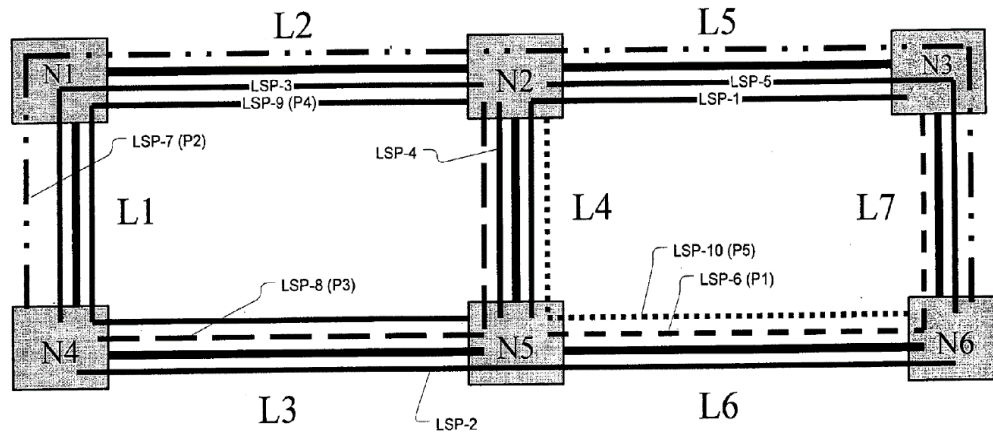
Exhibits 1011, 1022, and 1030 are documents published by the IETF describing MPLS networking standards and improvements, and a POSITA would have reasonably relied upon such documents. Ex.1003, ¶47. In fact, POSITAs frequently cited these exact documents before the ’821 priority date. Ex.1005, [0056], [0265] (citing RFC3209); Ex.1035, [0013], [0040]-[0041] (citing RFC3209); Ex.1036, [0011], [0040]-[0041] (citing RFC3209); Ex.1028, 2:22-24 (citing RFC3469); Ex.1029, [0047] (citing RFC3272). Ex.1003, ¶¶47-48.

B. Ground 1: Claims 1-7, 9-11, 13, and 17-20 are obvious under 35 U.S.C. § 103(a) over Doshi in view of Guichard.

1. Summary of Doshi

Like the ’821 patent, Doshi (Ex.1005) generally addresses path restoration and recovery. Ex.1005, [0008], Title, Abstract. Doshi, in the context of Figure 1, discloses a shared mesh data network “SMDN 100” that supports an MPLS architecture. Ex.1005, [0048]-[0049]; Ex.1003, ¶¶49-51.

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Ex.1005, Fig. 1.

In the above figure, the MPLS architecture includes a plurality of Label Switched Path (“LSP”) pairs (e.g., LSP-1 and LSP-6) between two nodes (e.g., between N3 and N5). The LSP pair includes a “primary” (or a “working”) LSP and a “protection” (or “restoration”) LSP. Ex.1005, [0046], [0052]-[0054], [0076]. The protection LSPs serve as a backup path if the primary LSP fails. Ex.1005, [0052]-[0054], [0266]-[0267]; Ex.1003, ¶52.

Doshi describes a selection method performed by a “network manager,” which determines the cost of each LSP pair and then selects the LSP pair with the overall-minimal cost. Ex.1005, [0014], [0142]-[0145], Figs. 10 and 11. The determination considers several factors, including “link utilization, utilization threshold, administrative weight, and sharing degree” and path disjointedness.

Ex.1005, [0142]-[0144]. Doshi explains that the benefit of disjoint paths is that “a failure affecting one of them will not affect the other.” Ex.1005, [0040]; Ex.1003, ¶¶50-53.

Doshi’s Figure 11, reproduced below, illustrates a logical flowchart for the selection method. Ex.1003, ¶¶52-54.

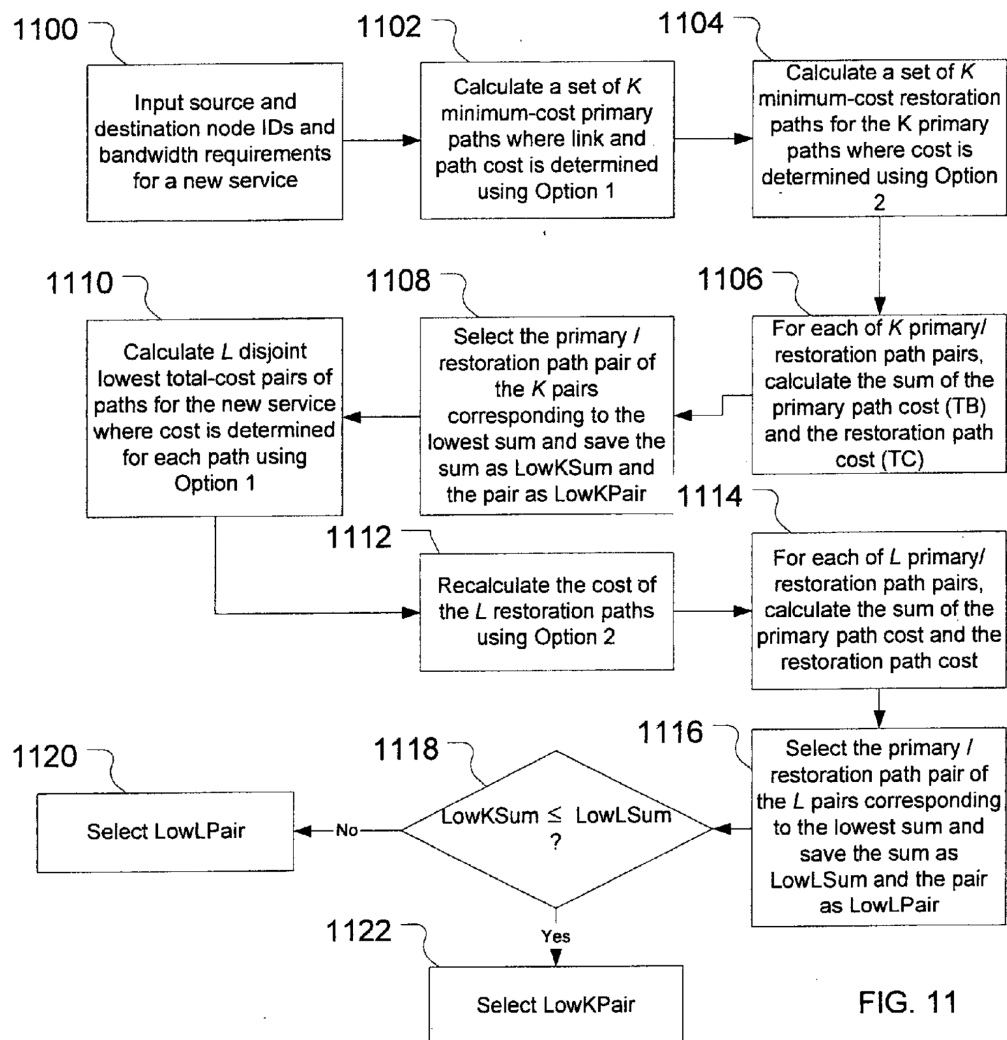


FIG. 11

Ex.1005, Fig. 11.

2. Summary of Guichard

Guichard (Ex.1006) similarly addresses MPLS LSP selection (or reselection), in the context of reoptimization. Ex.1006, 79-81. Guichard teaches that the network may change over time, including nodes and links failing and being restored and new LSPs being added or removed. Ex.1006, 79. These changes present the opportunity to evaluate the available paths and, if warranted, reoptimize the selected LSP by selecting a different LSP if a better path is available. Ex.1006, 79. Guichard provides several reoptimization schemes, including: manual reoptimization, timer-based reoptimization, and event-driven reoptimization. Ex.1006, 80-81; Ex.1003, ¶¶55-56.

3. Reasons to Combine Doshi and Guichard

A POSITA would have been motivated to combine the teachings of Doshi and Guichard. A POSITA would have found it obvious after selecting MPLS LSPs for communication between two nodes, as described by Doshi, to evaluate if the selection should be reoptimized such that a different LSP would be selected when the network changes. Guichard teaches such reoptimization of MPLS LSPs, which it characterizes as “highly desirable.” Ex.1003, ¶57.

First, Doshi and Guichard are analogous art to the '821 patent since they generally pertain to MPLS networks and address the problem of selecting LSPs. Ex.1005, [0014], [0049]; Ex.1006, 79-81. Thus, given the similar subject matter, a

POSITA considering Doshi would have naturally considered the teachings of Guichard. Ex.1003, ¶58.

Second, a POSITA would have been motivated to combine the teachings of Doshi and Guichard to produce numerous predictable and beneficial results. Ex.1003, ¶59.

Doshi teaches performing cost calculations and selecting an MPLS LSPs pair that has an overall minimum-cost. Ex.1005, [0014], [0049]. Guichard complements Doshi by teaching how to reoptimize an LSP selection. According to Guichard, it is “**highly desirable** to detect the existence of [network changes] and reoptimize a TE LSP along a better path when it becomes available.” Ex.1006, 79. Guichard’s reoptimization evaluation may be manually triggered, time-based, or event-driven (e.g., change in the network such as LSP set up and tear down, etc.). Ex.1006, 79-81; Ex.1003, ¶60.

A POSITA would have been motivated to perform reoptimization evaluations, as taught by Guichard, when implementing Doshi’s pair calculation and selection techniques to identify a potentially better LSP (e.g., for primary or protection LSP paths) with an even lower overall minimum-cost. Doshi’s initial LSP path selection identifies and selects the lowest cost pair of paths at a point in time; however, a POSITA would have recognized that it would be advantageous—indeed “highly desirable,” as Guichard puts it—to evaluate the potential for

reoptimization to determine whether the selected LSP pair remains the overall minimum-cost pair or whether there is a better pair available for reoptimization. Performing repeated reoptimization evaluations (based on various triggers), as taught by Guichard, furthers Doshi's stated objective of using the optimal path. Ex.1005, [0172] ("...path selection is a powerful tool that can be used...[for] **optimization.**"), [0200] ("...making an **optimal** restoration path choice..."). For instance, reoptimization would allow for selecting a shorter path if one becomes available. Doshi describes attempting to identify the shortest primary and protection paths as part of optimization. Ex.1005, [0151], [0165], [0172]; Ex.1003, ¶61.

The combination represents the use of a known technique (Guichard's reoptimization evaluation in response to various triggers) to improve a similar system or device (Doshi's MPLS architecture) in the same way with predictable results (ongoing optimization). The combination represents what would have been common sense to a POSITA—that it is desirable to evaluate whether selected LSPs remain optimal and to reoptimize the selection if a better option is available. Ex.1003, ¶62.

The results would have been predictable and there would have been a reasonable expectation of success since Doshi and Guichard both address the same technology. Also, a POSITA would have had a reasonable expectation of success

in reoptimizing Doshi's LSP pair selection because Guichard provides significant implementation details, including when to trigger reoptimization evaluations and how to "avoid network instabilities." Ex.1006, 81. The reasonable expectation of success is also evidenced by other skilled artisans that had reoptimized similar systems. Ex.1009, 136; Ex.1010, 1; Ex.1023, 34; Ex.1034, [0027]-[0033], claim 19; Ex.1035, [0024]; Ex.1003, ¶¶63-65.

Implementing the combination would be within a POSITA's skillset since Doshi already sets forth the calculation and selection techniques that would be utilized during the reoptimization evaluation. Also, since Doshi is already "monitoring and updating...network topology" (Ex.1005, [0270]-[0281]) event-based reoptimization evaluation per Guichard, would be directly applicable. Doshi itself acknowledges that a POSITA would have had the necessary skill set to make "[v]arious modifications of the described embodiments." Ex.1005, [300]; Ex.1003, ¶¶64-66.

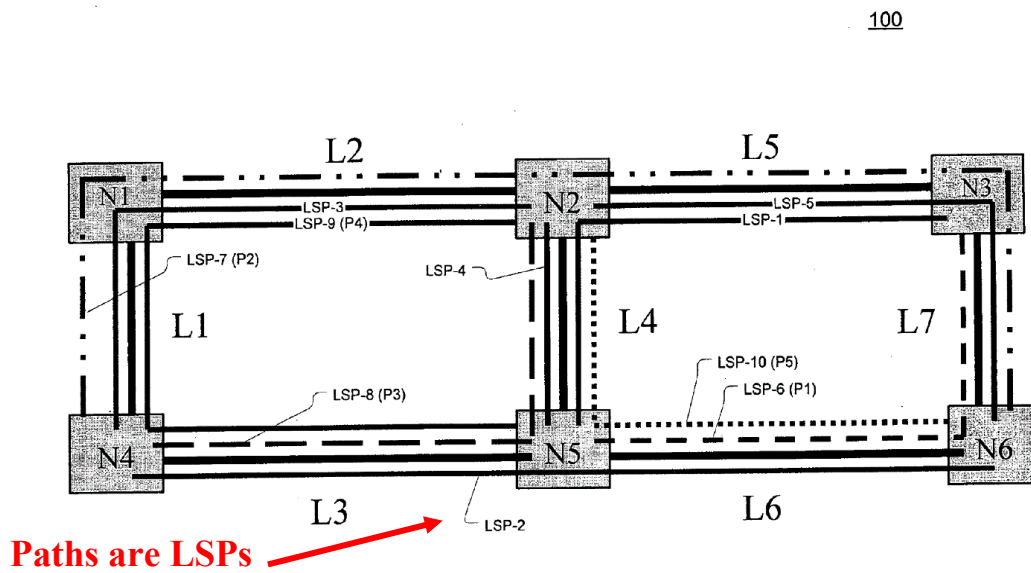
4. Claim 1

[1.0] *An entity selection method performed by a network device, comprising the steps of:*

As analyzed in the Claim Construction section (§VI.A), the scope of the term "*entity*" includes an MPLS LSP. As shown below, Doshi discloses an MPLS LSP ("*entity*") selection method performed by a network manager ("*network*

device”); Ex.1003, ¶67.

Doshi discloses a shared mesh data network “SMDN 100” that is configured to “support[] the **multiprotocol label switching (MPLS) architecture standard**” of “RFC3031.” Ex.1005, [0049]. Doshi’s Figure 1, reproduced below, illustrates SMDN 100 that has MPLS LSPs (e.g., LSP-1 to LSP-10) between nodes (e.g., N1-N6). Ex.1005, [0016], [0052]-[0054]; Ex.1003, ¶70.



Ex.1005, Fig. 1 (annotated); Ex.1003, ¶70.

In the MPLS context, Doshi teaches a “**method ...implemented by a network manager** for the mesh network.” Ex.1005, [0014]; [0049] (“The concepts of the present invention are discussed **in the context of ...[a] mesh network (e.g.,... MPLS)**”). The network manager is implemented in a network device, such as a server or distributed partially or fully to nodes. Ex.1005, [0271]; *see also*

Ex.1005, [0082], claim 11. The network manager performs the method, so that **“primary and restoration paths ... are selected** from the plurality of candidate path pairs based on the path cost of each candidate path pair.” Ex.1005, [0014]; *see also* Ex.1005, [0142] (“In the first flow, illustrated by steps 1102, 1104, 1106, and 1106, one minimum-cost path pair is **selected** from K candidate pairs by a first method.”), claim 11, [0141]-[0145], [0156], [0270]-[0281], Abstract, Figs. 10, 11, 17, 18; Ex.1003, ¶¶68-69.

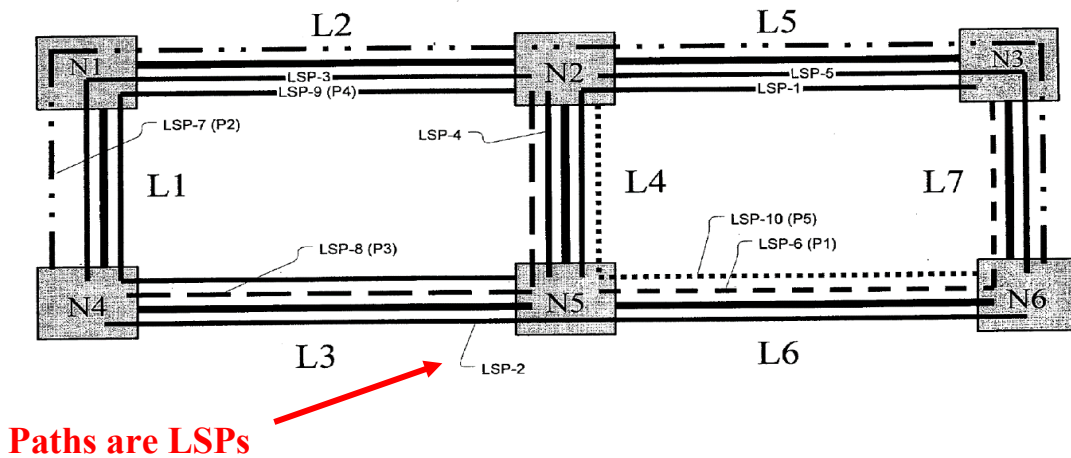
A POSITA would have found it obvious, because SMDN 100 supports MPLS, for the “paths” to correspond to LSPs, since those are the paths used for MPLS networks. Ex.1003, ¶71.

Thus, Doshi’s description of an MPLS LSP selection method performed by a network manager, renders obvious the preamble. Ex.1003, ¶¶67-73.

[1.1] providing a plurality of multi protocol label switching (MPLS) transport entities between a first endpoint and a second endpoint;

As analyzed above, Doshi’s SMDN 100 is configured to support MPLS. Ex.1005, [0049]. Doshi illustrates at Figure 1 that the MPLS network “has been provisioned” with a plurality of LSPs (e.g., “LSP-1” to “LSP-10”) between nodes (e.g., N1-N6), at Figure 1. Ex.1005, [0016], [0050]-[0054]; Ex.1003, ¶¶74-76.

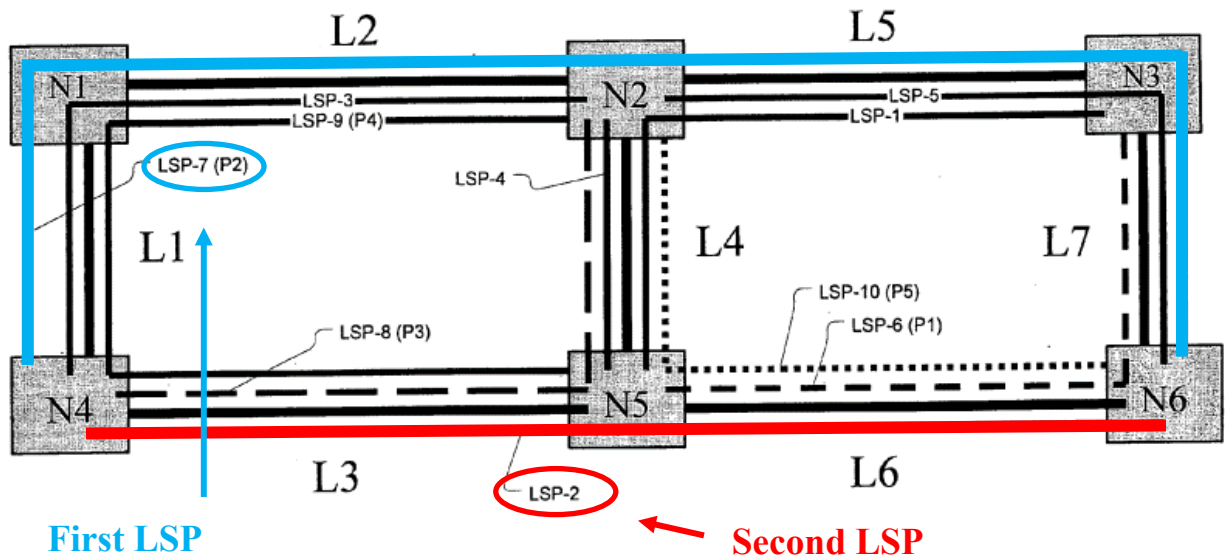
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Ex.1005, Fig. 1 (annotated); Ex.1003, ¶75.

The LSPs are provisioned “**between two nodes**” that correspond to “**source and destination nodes**” or “**end nodes of an LSP.**” Ex.1005, [0050], [0154]-[0156], [0267]; *see also* [0056], [0142], [0188], [0190], [0192], [0195], Fig. 5, Fig. 8, Fig. 11, Fig. 17, Fig. 18, and Fig. 20. Since Doshi’s LSPs are provided “*between*” and terminate at two end nodes, a POSITA would have understood that one end node (e.g., source node) corresponds to “*a first endpoint*” and that the other end node (e.g., destination node) corresponds to “*a second end point.*” Any two (or more) LSPs provided between two end nodes correspond to “*a plurality of multi protocol label switching (MPLS) transport entities.*” Ex.1003, ¶¶77-78.

Below is an example of providing LSP-2 (a “primary” path Ex.1005, [0052]) and LSP-7 (a “protection” path Ex.1005, [0054]) between end node N4 and end node N6. Ex.1003, ¶79.



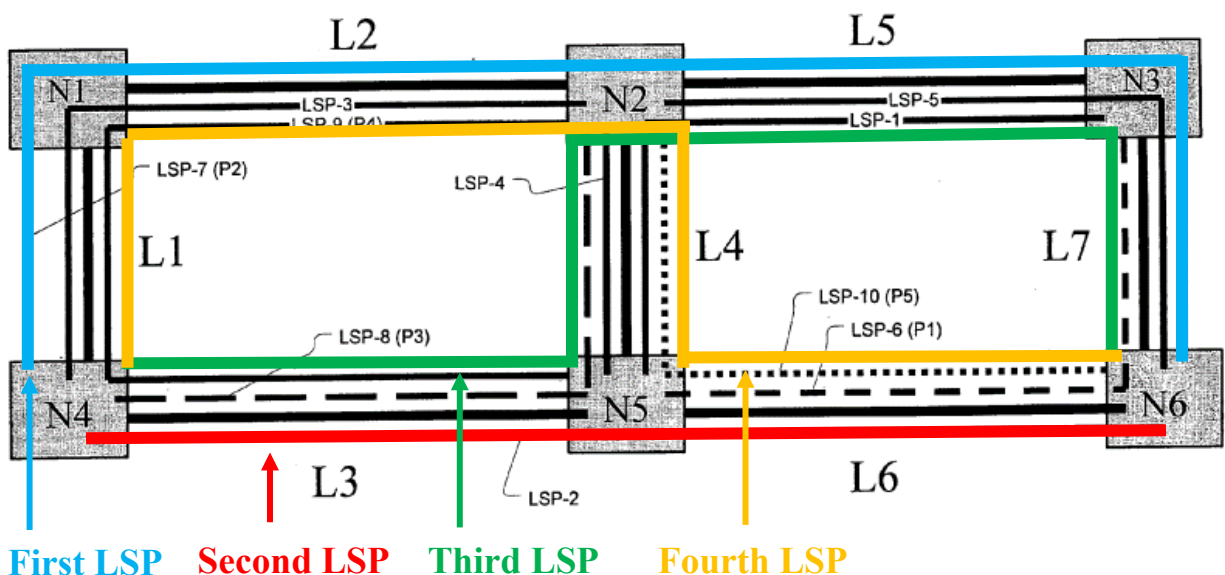
Ex.1005, Fig. 1 (annotated); Ex.1003, ¶79.

Although Figure 1 only illustrates two LSPs between N4 and N6, Doshi makes clear that this figure is merely “**exemplary**” and expressly teaches “**two or more paths between**” the end nodes. Ex.1005, [0016], [0048]-[0055]. Doshi also contemplates making “[v]arious **modifications**” to the exemplary embodiments. Ex.1005, [0300]; Ex.1003, ¶80.

Accordingly, POSITA would have found it obvious to provide additional LSPs between two nodes. Ex.1003, ¶81. That is, it would have been obvious to a person of skill to provide enough LSPs between two nodes to meet bandwidth requirements for communication between the nodes. Doshi itself contemplates more than two LSPs between two nodes by disclosing “two or more paths between” the end nodes and that there are a “plurality of candidate path pairs,”

from which to select for communication. Ex.1005, Abstract, [0014], [0048]. This would mean that any two nodes would have at least two primary LSPs and two protection LSPs, with different primary and protection LSP combinations corresponding to candidate pairs. *See* Ex.1005, [0014], (“...each candidate path pair comprising a candidate primary path and a candidate restoration path...”); *see also* [1.2]-[1.5]; Ex.1003, ¶81

Modified Figure 1 below provides an example of providing two primary LSPs and two protection LSPs between nodes N4 and N6. Ex.1003, ¶82.



Ex.1005, Fig. 1 (modified and annotated); Ex.1003, ¶82.

A POSITA would have recognized that providing more than two LSPs between each node pair (e.g., at least two primary LSPs and two protection LSPs) would be beneficial since doing so facilitates path diversity to reduce the

probability of service interruption between the nodes. Ex.1003, ¶83. For example, the illustrated Third and Fourth LSPs between N4 and N6 offers additional protection against failures along different paths, at least in part. A concurrent failure of, for example, L2 and L6 would cause both the First and Second LSP (the original two LSPs illustrated in Doshi) to go down; however, such a failure would not bring down the Third LSP. Having the Third LSP available would allow traffic to be switched over with minimal interruption of service as compared to if the First and Second LSPs were the only LSPs connecting N4 and N6. Having the Fourth LSP available in the event of concurrent failure of, for example, L3 and L7 (which would affect both the First and Second LSP without affecting the fourth LSP) would similarly allow traffic to be switched over to the Fourth LSP with minimal interruption of service. Ex.1003, ¶83.

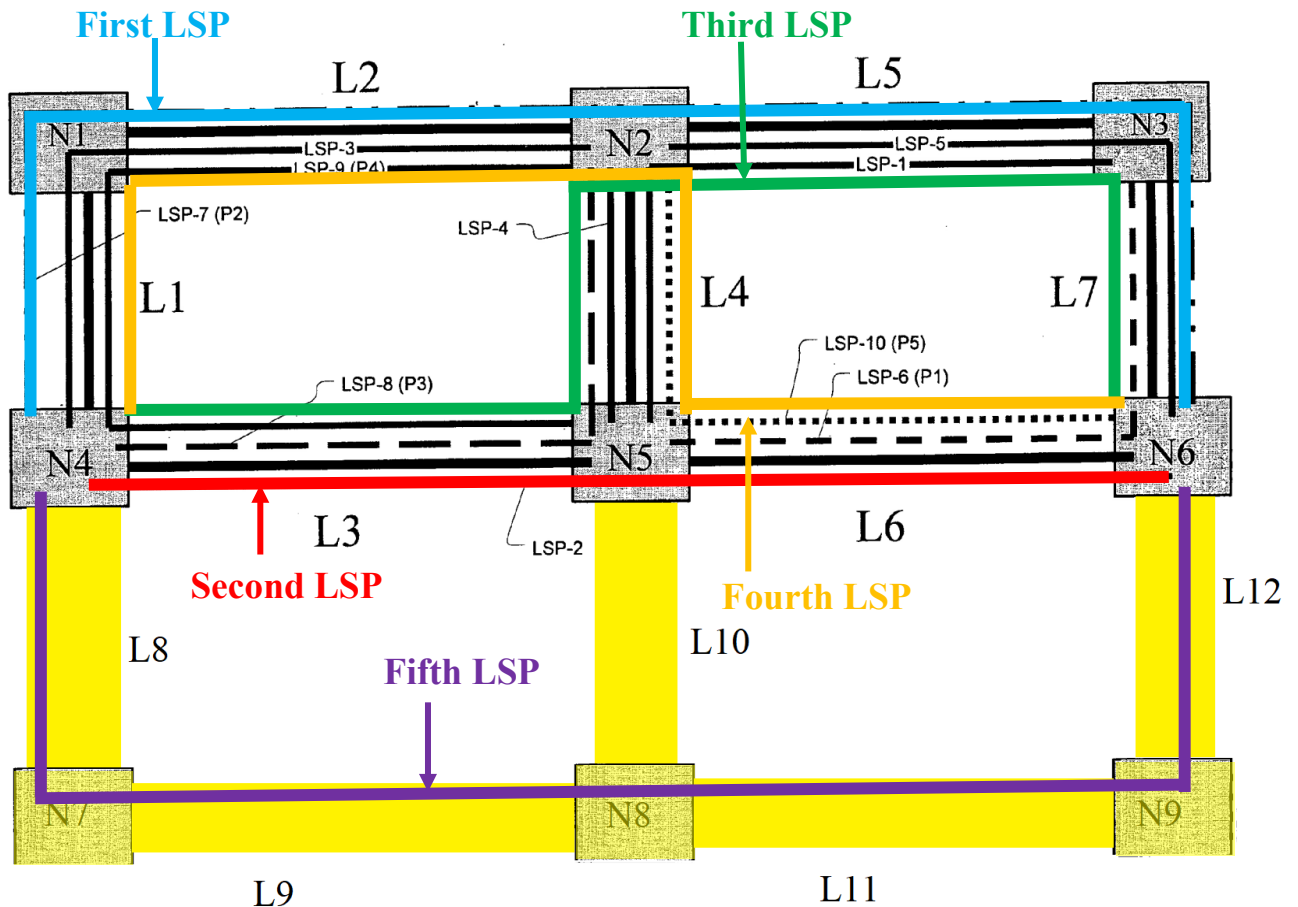
Providing more than two LSPs between two end nodes is desirable because it facilitates reoptimization by providing more potential paths to select from over time. As analyzed below at [1.3]-[1.5], it was known in the art that it is “highly desirable” to reoptimize LSP selection over time. Ex.1006, 79-81. When reoptimizing, a POSITA would have understood to consider all available LSP paths and choose the optimal LSP pair (e.g., primary and protection LSPs). The desirability of optimizing selection is recognized by Doshi, which recognizes the desirability of “optimization.” Ex.1005, [0172]; *see also* Ex.1005, [0200]. If only

one primary LSP and one protection LSP was provided between two end nodes, then reoptimization would not be possible in some failure situations. Thus, facilitating reoptimization is another benefit of providing more than two LSPs between each node pair in Doshi. Ex.1003, ¶85.

Another advantage of having is that it allows traffic with different quality of service (QoS) requirements to be allocated and aggregated on different LSPs. *See* Ex.1005, [0265],[0272]. For example, traffic with a high QoS requirement, e.g., video traffic, would be assigned to an LSP configured to handle such high QoS traffic while traffic with a lower QoS requirement would be assigned to a different LSP. Ex.1003, ¶84.

Moreover, it would have been understood that additional nodes with corresponding LSPs not illustrated would be present or may be added over time, as both Doshi and Guichard teach. *See, e.g.*, Ex.1005, [0055] (Describing that other paths and nodes may exist); Ex.1006, 79 (“Network state keeps changing. Links and nodes fail and recover...new TE LSPs are set up...”). A POSITA would have been motivated to provide additional LSPs along new links between new nodes in Doshi, as the network changes, so that the paths between two given nodes are completely disjointed, thereby further reducing the probability of service interruption. *See* Reasons to Combine Doshi and Guichard, § VIII.B.3; Ex.1003, ¶¶85-86.

Modified Figure 1 below illustrates additional nodes N7-N9 with new links L8-L12 that provide corresponding a new Fifth LSP between nodes N4 and N6:



Ex.1005, Fig. 1 (modified and annotated); Ex.1003, ¶87.

As illustrated, the Fifth LSP is completely disjoint with respect to the First and Second LSPs. Ex.1003, ¶¶87-88

Thus, Doshi in combination with Guichard discloses providing a plurality of MPLS LSPs (e.g., at least two primary LSPs and at least two protection LSPs) between a first end node (e.g., source node) and a second end node (e.g., destination node), which renders obvious this limitation. Ex.1003, ¶¶74-89.

[1.2] *determining an overall cost for each entity pair of said plurality of entities;*

Doshi calculates the cost of each path (e.g., each primary or protection path) as “the sum of the link costs.” Ex.1005, [0125], Fig. 10. Then, Doshi’s path cost is used to determine the cost of each path pair. **“For each of a plurality of candidate path pairs...a path cost associated with said each candidate path pair is generated.”** Ex.1005, [0014]; *see also* Ex.1005, Abstract, [0026], [0046], [0050]-[0054], [0076], [0082], [0130], [0124]-[0181], Fig. 1, Fig. 10, Fig. 11, Fig. 12, and Fig. 13; Ex.1003, ¶¶90-94.

Doshi’s cost determination takes into account whether path pair is “disjoint,” as well as other factors, such as the “link utilization, utilization threshold, administrative weight, and sharing degree.” Ex.1005, [0142], Ex.1005, [0146]-[0156], Fig. 11. Based on these factors, Doshi identifies the path pair with an **“overall-minimum cost.”** Ex.1005, [0142]; Ex.1003, ¶¶95-97.

Doshi’s Figure 11 (building upon Figure 10’s example for determining individual path cost), shows that the cost of each candidate pair is determined by summing a primary path cost and a protection path cost. Ex.1003, ¶95.

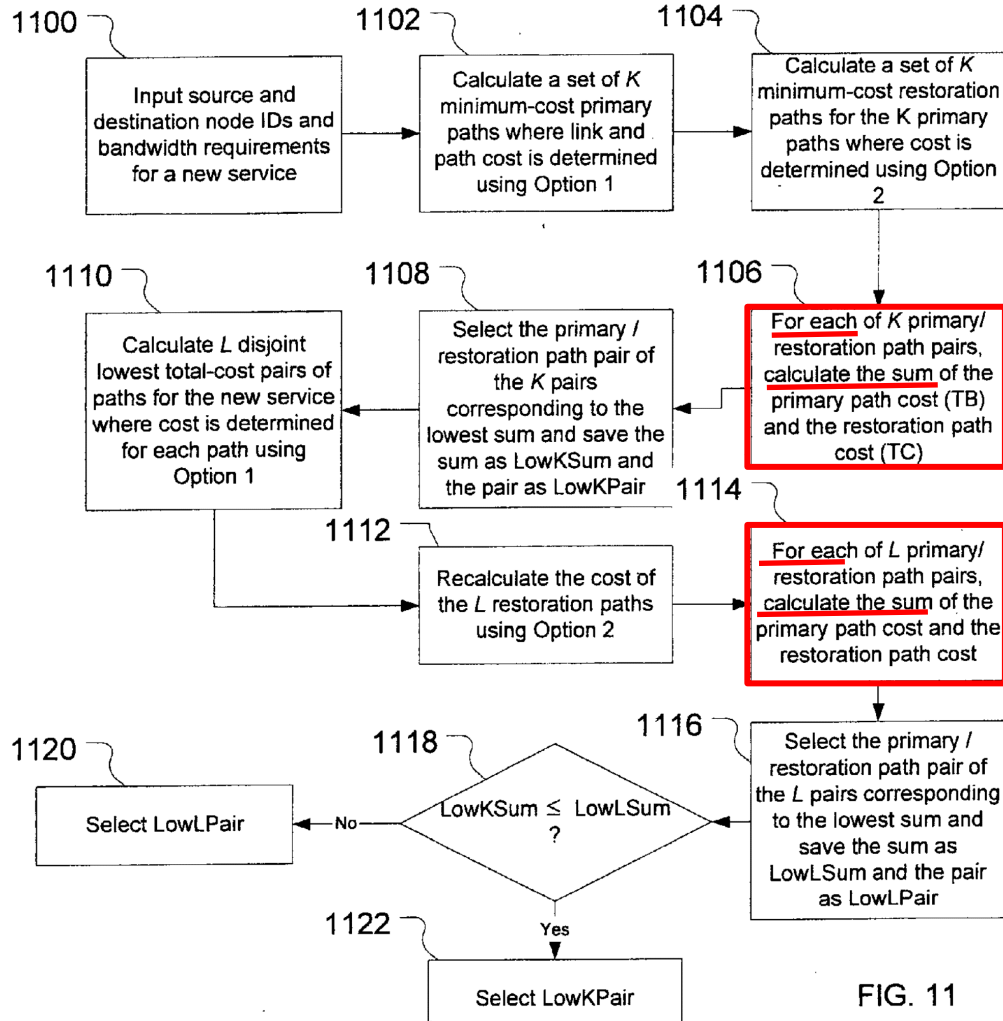


FIG. 11

Ex.1005, Fig. 11 (annotated); Ex.1003, ¶¶95.

A POSITA would have understood that Doshi’s cost determination—which considers a myriad of factors such as link utilization, sharing degree, and path disjointedness—represents the “*overall cost*” for each candidate path pair.

Ex.1003, ¶¶96-97.

Consistent with the analysis at [1.0]-[1.1], it would have been obvious for the path to be implemented as LSPs, since Figure 1 supports an MPLS architecture

and provides a plurality of LSPs. Also, a POSITA would have found it obvious for the candidate path pairs to be from the provided plurality of MPLS LSPs (at least two primary and at least two protection LSPs) between the end nodes (See [1.1]), because these LSPs would have already been in existence and available for immediate use for the new service. Ex.1003, ¶98.

By determining the cost for the provided LSPs, assessment can be made whether the provided LSPs have sufficient resources for the new service—without having to allocate additional resources. Considering the provided LSPs for the new service would allow such LSPs to be more fully utilized. Ex.1008, 1306 (describing the known problem of underutilized LSPs and solution of allocating traffic to such LSPs); Ex.1003, ¶99

Consistent with the analysis at [1.3]-[1.5] below, in view of Guichard’s teaching of ongoing reoptimization efforts, it would have been an obvious aspect of path selection to perform Doshi’s cost calculations repeatedly to attempt to determine whether the original LSP pair still has the overall minimum-cost or if there is another LSP pair that is more optimal. A POSITA would have understood that the cost calculations for such reoptimization efforts would consider existing paths, including, for example, an originally selected LSP pair that is currently being utilized. Ex.1003, ¶¶100-101.

[1.3] *selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and*

First, Doshi discloses that “**primary and protection paths...are selected from the plurality of candidate path pairs based on the path cost of each candidate path pair.**” Ex.1005, [0014]; *see also* Ex.1005, Abstract, [0046], [0076], [0142]-[0145], Claim 1, Claim 11. Consistent with the analysis at [1.1]-[1.2], it would have been obvious for the “plurality of candidate path pairs” (pairs of primary and protection LSPs) to correspond to the provided plurality of LSPs of the MPLS architecture. Ex.1003, ¶¶102-103.

Doshi further teaches that the selection is based on the overall cost, since “**the lowest-cost pair...is selected as the overall minimum-cost pair.**” Ex.1005, [0142]; *see also* Ex.1005, [0026], [0125]-[0139], [0143]-[0145]. Doshi’s Figure 11 and illustrates selecting the overall minimum-cost pair. Ex.1003, ¶104

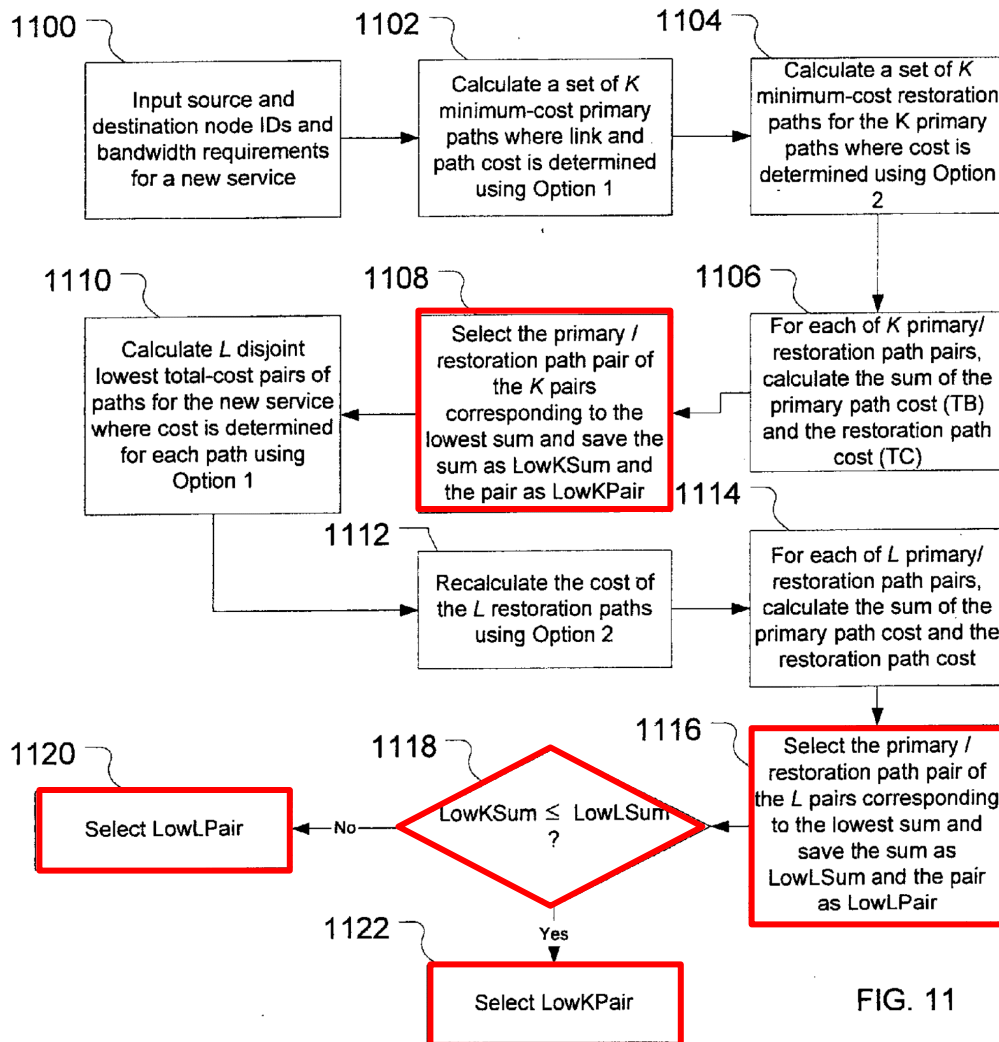


FIG. 11

Ex.1005, Fig. 11 (annotated); Ex.1003, ¶104.

Therefore, Doshi discloses selecting an LSP pair from the plurality of MPLS LSP based on the selected pair having the overall minimum-cost. Ex.1003, ¶¶102-105.

Second, Guichard teaches that it is “highly desirable” evaluate the selected LSP and reoptimize the selection “[i]f a better path is found” or if a “more optimal (shortest) path exists.” Ex.1006, 79. Guichard contemplates, for example, “Manual

reoptimization” and “Timer-based reoptimization.” Ex.1006, 81; *see also* Ex.1006, 79. Guichard merely describes what would have been common sense to a POSITA—reoptimizing a system to use the best available LSP. In other words, a POSITA would have understood that Guichard teaches that original path selections should be evaluated on an ongoing basis to determine whether better or more optimal paths exist. Ex.1003, ¶¶106-109.

In view of Guichard’s teachings, it would have been obvious to reoptimize Doshi’s LSP selection by performing cost calculations repeatedly over time (e.g., based on a manual trigger or timer-based) to determine whether the originally selected LSP pair still has the overall minimum-cost or if another LSP pair should be selected. A POSITA would have understood that the cost calculations for such reoptimization efforts would consider existing LSP paths, including, the originally selected LSP pair that had the overall minimum-cost. If the originally selected LSP pair still has the overall-minimum cost, a POSITA would have understood that Doshi’s selection techniques identified above would reselect the original pair. On the other hand, if another LSP pair is determined to have the overall-minimum cost, then that LSP pair would be selected. Each such selection is an example of “*selecting*,” as claimed. Ex.1003, ¶110

It would have been obvious to a POSITA, in view of Guichard, to perform ongoing reoptimization attempts, when implementing Doshi’s MPLS architecture,

so that an optimum LSP pair (e.g., overall minimum-cost pair) is selected over time for communication between two end nodes. In implementing the combination, a POSITA would have evaluated all existing available LSPs (including previously selected LSPs) by repeating Doshi's candidate pair cost determination (See [1.2]) and selection techniques (discussed above) in response to a manual trigger or expiration of a timer to thereby select the LSP pair with an overall minimum-cost. Ex.1003, ¶110.

A POSITA would have been motivated to perform ongoing reoptimization to identify potentially better primary and protection LSP paths (for the LSP pair between two end nodes) that minimize the overall cost. Ex.1006, 79 (“It is then **highly desirable** to detect...and reoptimize a TE LSP along a **better path** when it becomes available.”); Ex.1005, [0172] (“In general, path selection is a powerful tool that can be used to achieve...**optimization.**”) [0200] (“...making an **optimal** restoration path choice...”); *see also* Reasons to Combine Doshi and Guichard, § VIII.B.3; Ex.1003, ¶111.

Below is an example of such a selection, per the combined teachings, in the context of Doshi's modified Figure 1. Ex.1003, ¶112.



pair (e.g., the Fifth LSP as the primary and the Second LSP as the protection) as having the overall minimum cost. In such a circumstance, these LSPs would be selected for further communications between end nodes N4 and N6 while the First LSP would be replaced by the Fifth LSP. Ex.1003, ¶¶113-114.

[1.4] if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,

First, Guichard teaches “**Event-driven reoptimization**” where “**it may be desirable to trigger a reoptimization upon the occurrence of a particular event**, such as the restoration of a link in the network.” Ex.1006, 81. Additionally, “the evaluation of any potential reoptimization” is triggered “each time a new link is advertised as newly operational.” Ex.1006, 81; *see also* Ex.1006, 79-80 (triggering reoptimizing when links and nodes fail or recover and when new LSPs are set up or torn down and a better path is available). Ex.1003, ¶¶115-116.

A POSITA would have understood that Guichard generally teaches that the current LSP path selection should be evaluated following a trigger event (e.g., LSP set up, LSP torn down, restoration of a link, or new link) to determine whether a more optimal LSP path is available. Also, a POSITA would have recognized that this evaluation may or may not result in a reoptimization. *See* Ex.1006, 81 (referring to “evaluation of any **potential** reoptimization.”); Ex.1035, [0057]-[0059] (recognizing that if “new cost exceeds the old cost ... no optimization of

the TE-LSP is performed.”). A person of skill would have understood that there is only a potential for reoptimization since if the evaluation indicates that the currently utilized path is still the best option, then no reoptimization would occur and the previously utilized path is reselected. Ex.1003, ¶117.

It would have been obvious to a POSITA, in view of Guichard, to perform event-driven reoptimization, when implementing Doshi’s MPLS architecture, to determine if there are better LSP paths available or if the currently selected LSP pair represents the overall minimal cost. *See* Reasons to Combine Doshi and Guichard, § VIII.B.3; Ex.1003, ¶118.

In implementing the combination with Doshi, a POSITA would have evaluated any restored and new LSPs along with all existing LSPs (including the currently utilized LSP pair) by repeating Doshi’s candidate pair cost determination and selection techniques (See [1.2]-[1.3]) in response to a trigger event to potentially reoptimize the selection. Ex.1003, ¶119.

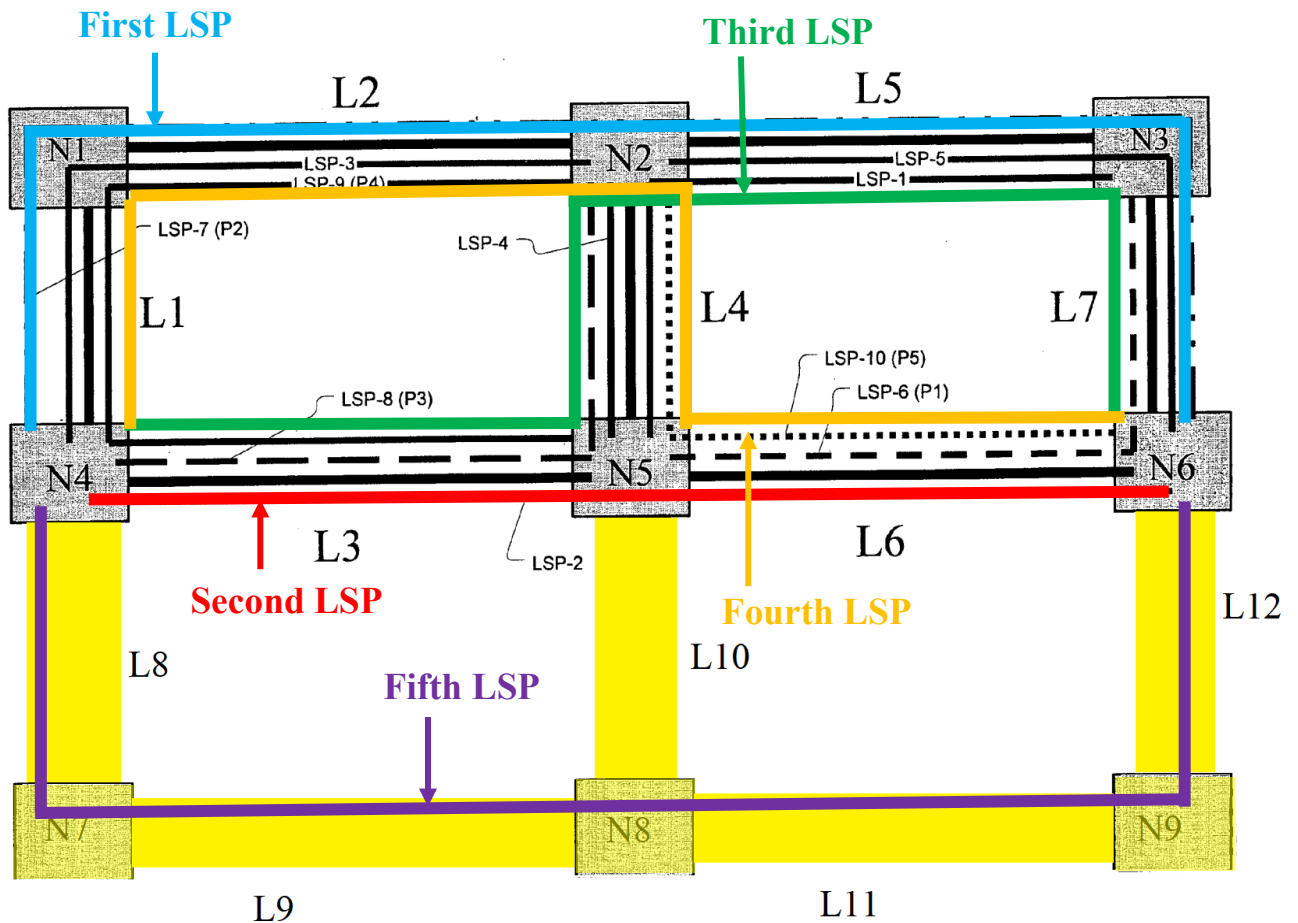
It would have been obvious to a POSITA that repeating Doshi’s candidate path pair cost determination and selection would—in certain instances—result in the reselection of the currently utilized LSP pair. This would be the case where the currently utilized LSP pair still provides the overall minimum-cost, despite an LSP path being restored, a new LSP path being set up, or some other change in the network. In the combination, Doshi’s currently utilized LSP pair would be

repeatedly evaluated and reselected, per Guichard’s event-driven reoptimization technique, if it continues to have the overall-minimum cost per Doshi’s cost determination (See [1.2]). Ex.1003, ¶120.

Thus, Doshi in combination with Guichard discloses an event triggering candidate pair cost determination and, if the cost determination indicates that the currently used LSP pair still has the overall-minimum cost, reselecting the LSP pair, which renders obvious “*if an entity pair reselection event occurs, reselecting said entity pair.*” See also [1.5], below, analyzing further the reselection event. Ex.1003, ¶121.

Second, as discussed above at [1.0]-[1.3], Doshi’s plurality of candidate path pairs include a plurality of LSPs (e.g., at least two primary and at least two protection LSPs) between a pair of end nodes. The currently used primary and protection LSP pair would be initially selected based on the overall minimum cost (see [1.3]) and the remaining LSPs would be available (with any restored or new LSPs in the network that generate the trigger event, per Guichard) as potential replacements during reoptimization. Thus, in the proposed combination, the reselection is “*from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair.*” Ex.1003, ¶122.

As an example, consider the modified Figure 1, per the combined teachings, discussed at [1.3], and reproduced below. Ex.1003, ¶123



Ex.1005, Fig. 1 (modified and annotated); Ex.1003, ¶123.

As noted at [1.3], the selection step selected the Fifth LSP as the primary path and the Second LSP as the protection path. When performing event-driven based reoptimization, per Guichard, an overall cost for each LSP pair permutation would be determined, per Doshi. Ex.1005, [0014] (“...a path cost associated with

said each candidate path pair is generated...”). If the cost determination indicates that the currently used LSP pair (e.g., Fifth LSP and Second LSP) still has the overall-minimum cost, then the same LSP pair would be reselected. Ex.1005, [0142] (“...the lowest-cost pair...is selected as the overall minimum-cost pair...”); Ex.1003, ¶124.

Since Doshi’s cost determination is performed on each candidate path pair, it would have been obvious to a POSITA for the reselection to be from the group consisting of the currently used LSP pair (e.g., Fifth LSP and Second LSP) and a replacement LSP pair comprising at least one LSP distinct from the currently used LSP pair. Ex.1003, ¶125. In the present example, the reselected LSP pair (e.g., Fifth LSP and Second LSP) would correspond to “*said entity pair*” while each remaining permutation of LSP pairs not reselected would correspond to “*a replacement entity pair comprising at least one entity distinct from the entities of said entity pair.*” Ex.1003, ¶125.

Third, to the extent argued that “*reselecting said entity pair*” requires selecting at least one different LSP as part of the pair instead of reselecting the same two LSPs, the proposed combination also renders that obvious. A POSITA would have found it obvious to select a different LSP pair, when the different LSP pair is determined to have a lower overall-minimum cost than the currently used LSP pair. To illustrate, in the present example, if the First LSP and Second LSP are

now determined to have the lowest overall-minimum cost, then that LSP pair would be reselected. Ex.1003, ¶¶115-127.

[1.5] wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.

Guichard teaches that reoptimization evaluation is triggered by various events (“*entity pair reselection event*”). For example, Guichard’s event-driven reoptimization is triggered “if a **link is restored** in the network” and “each time a **new link is advertised as newly operational.**” Ex.1006, 81. A POSITA would have understood that restoring a link restores LSPs of the link, which may provide a more optimal path. As discussed above at [1.0]-[1.4], the plurality of MPLS LSPs between end nodes correspond to “*said plurality of transport entities.*” It follows that restoring a link that previously went down to “newly operational,” means that the operational status of the link’s LSPs has also changed to operational, which discloses “*an operational status change for one of said plurality of transport entities.*” Ex.1003, ¶¶128-130.

Another network change event contemplated by Guichard is when “**new...LSPs are set up**” and when “others may be **torn down.**” Ex.1006, 79. Because these events have the potential for “a more optimal path [to] appear in the network. It is then highly desirable to detect the existence of such a path and

reoptimize a TE LSP along a better path when it becomes available.” Ex.1006, 79.

It follows that a new LSP set up between end nodes would be added to the plurality of MPLS LSPs between the end nodes, which corresponds to “*adding an entity to said plurality of transport entities.*” Conversely, tearing down an LSP between the end nodes would remove the LSP from the plurality of MPLS LSPs between the end nodes, which corresponds to “*removing an entity from said plurality of transport entities.*” Ex.1003, ¶¶132-133.

5. Claim 2

[2.1] *The method of claim 1, wherein said step of selecting an entity pair further comprises: selecting a working entity from said entity pair; and selecting a protection entity from said entity pair.*

As discussed above at [1.3], Doshi discloses selecting an LSP pair from the plurality of MPLS LSPs. The selection includes selecting a primary path (Doshi also refers to as a “working path”) and selecting a “protection path,” which corresponds to “*selecting a working entity*” and “*selecting a protection entity.*” Ex.1005, [0014], [0046]; *see also* Ex.1005, Abstract, [0142]-[0145], Claim 1, Claim 11; Ex.1003, ¶¶134-135.

The ’821 patent describes “switch[ing] between a working entity and a protection entity” after failure. Ex.1001, 1:51-43; 2:35-36. Doshi similarly describes “Switching Between Working and Protection LSPs” “after detecting a failure.” Ex.1005, [0266]-[0267]. Doshi’s working LSP corresponds to a “*working*

entity” and its protection LSP corresponds to a “*protection entity*.” Since Doshi’s working and protection LSPs are part of the selected LSP pair, a POSITA would have understood that the selection of the working and protection LSPs are “*from said entity pair*.” Ex.1003, ¶¶136-137.

6. Claim 3

[3.1] *The method of claim 2, further comprising the step of selecting an active entity from the set consisting of said working entity and said protection entity.*

As discussed at [2.1], Doshi describes selecting a working LSP (“*working entity*”) and a protection LSP (“*protection entity*”). Doshi further describes “Switching Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Ex.1005, [0266]-[0267]. Doshi’s working LSP is the path actively carrying traffic absent a failure while Doshi’s protection LSP becomes active when traffic is switched over following a failure. Thus, Doshi’s switching decisions, which select which of the working LSP and protection LSP is in use, render obvious this limitation. Ex.1003, ¶¶138-140.

7. Claim 4

[4.1] *The method of claim 2, wherein selecting an entity pair further comprises minimizing an overall cost function.*

As discussed at [1.2]-[1.3], Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair and sums the path costs

to find the cost of the pair together. The cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness, and which represent the “*overall cost*” for each candidate path pair. The calculation used to determine the “*overall cost*” corresponds to the claimed “*overall cost function*.” Ex.1003, ¶142.

Doshi’s Figure 11 and accompanying description teach calculating and selecting an “**overall minimum-cost**” pair. Ex.1005, [0142]; *see also* Ex.1005, [0026], [0125]-[0139], [0143]-[0145]. Ex.1003, ¶¶143-144.

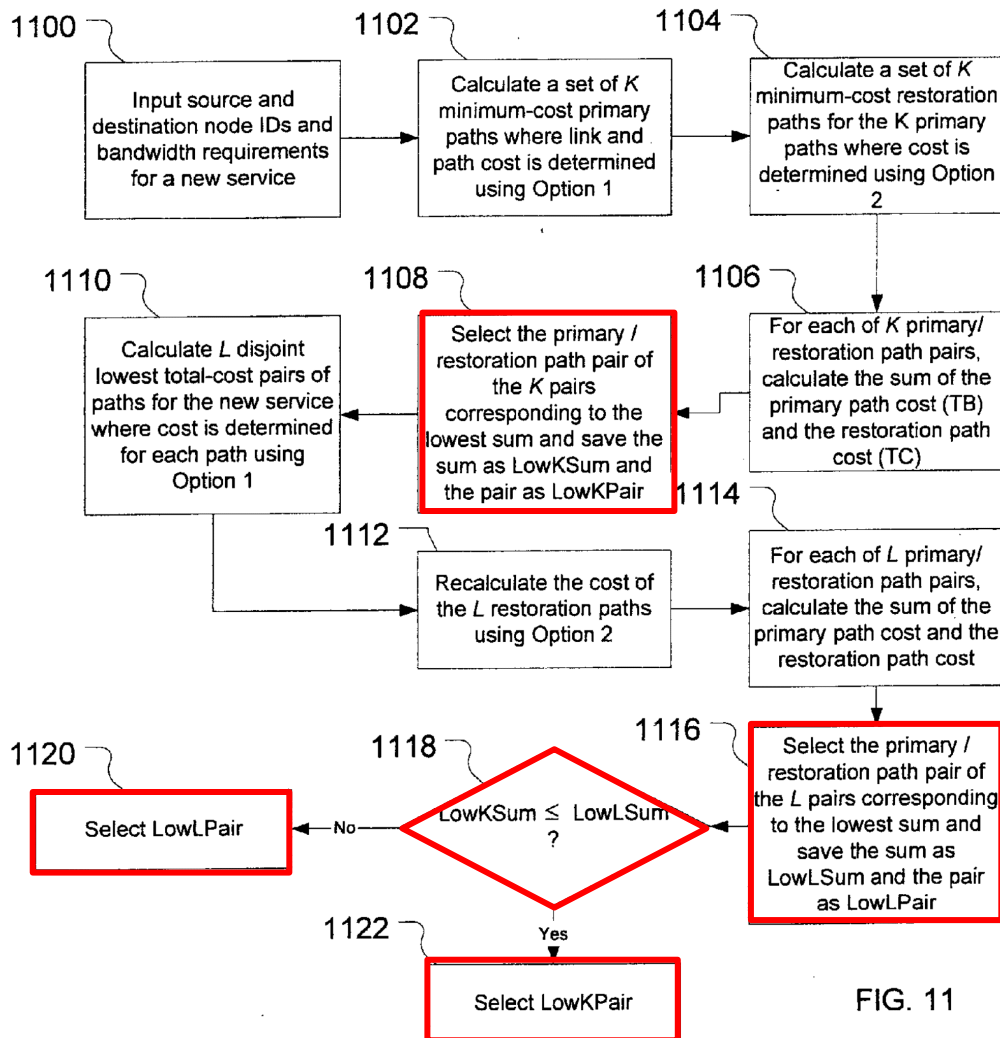


FIG. 11

Ex.1005, Fig. 11 (annotated); Ex.1003, ¶143.

A POSITA would have understood that the selected “overall minimum-cost” pair is the LSP pair having the lowest overall cost function in consideration of various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness. Thus, Doshi renders obvious this limitation. Ex.1003, ¶¶141-145.

8. Claim 5

[5.1] *The method of claim 4, wherein said overall cost function comprises substantially minimizing a probability of concurrent failure of said protection entity and said working entity.*

As discussed at [1.2]-[1.3], and [4.1], Doshi calculates the path cost of each primary “*working entity*” and protection LSP “*protection entity*” in a candidate path pair and sums the path costs to find the cost of the pair together. The cost calculation considers a myriad of factors such as link utilization, sharing degree, and path disjointedness and which represent the “*overall cost*” for each candidate path pair. The calculation used to determine the “*overall cost*” corresponds to the claimed “*overall cost function.*” Ex.1003, ¶147.

Doshi describes selecting primary LSP and protection LSPs that are “**strictly disjoint**” from each other, having “no common links or nodes other than their common ingress and egress nodes.” Ex.1005, [0053]; Ex.1003, ¶¶148-150.

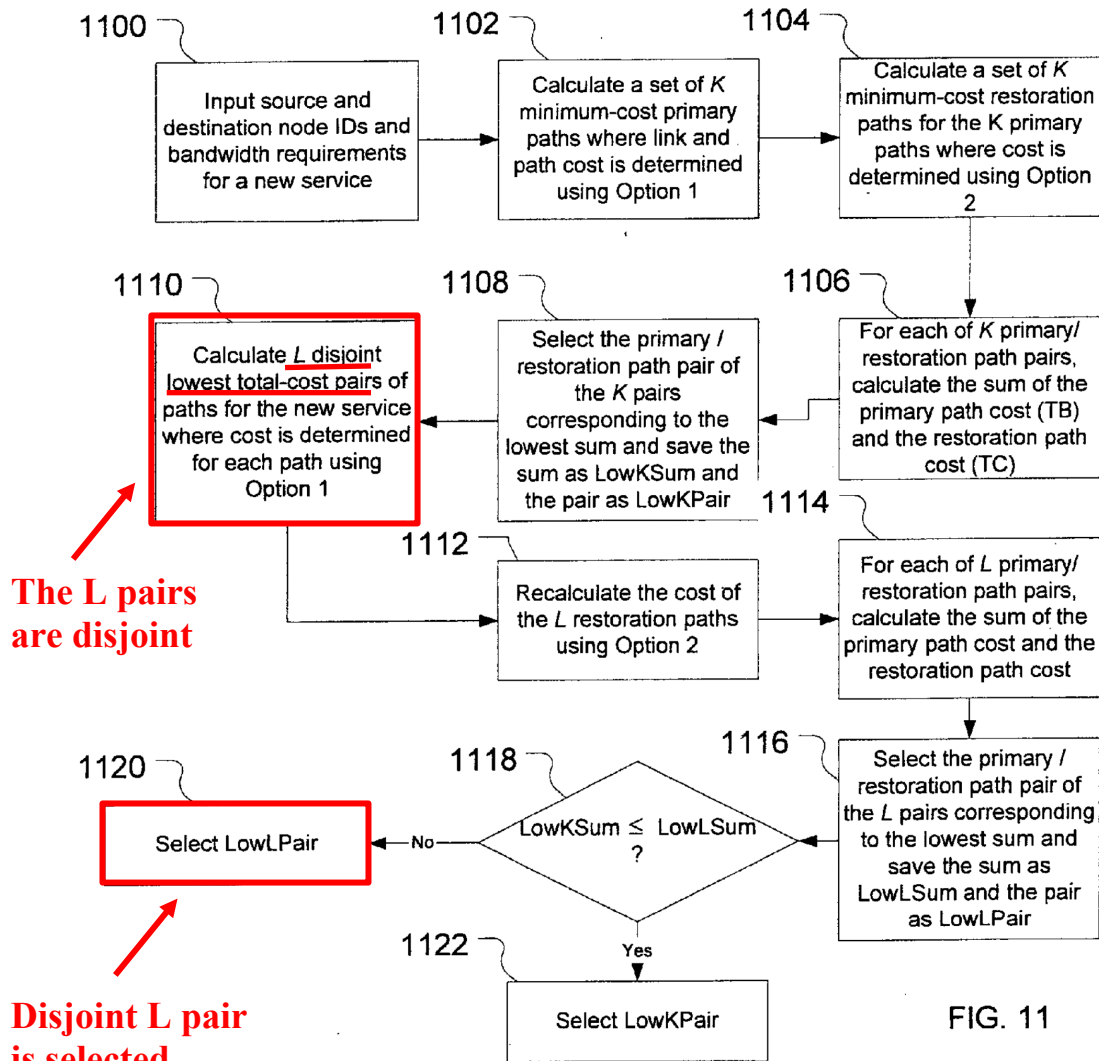


FIG. 11

Ex.1005, Fig. 11 (annotated); Ex.1003, ¶148.

When two paths are strictly disjoint, “**then a failure affecting one of them will not affect the other.**” Ex.1005, [0040]; *see also* Ex.1005, [0155] (Failure “**protection is made possible by selecting...disjoint [paths].**”); Ex.1005, [0056], [0062], [0080], [0131], [0142]-[0156], [0287], Fig. 1. By considering path disjointedness in its cost calculation and selecting a pair of primary and protection

paths that are node and link disjoint such that the failure of one does not affect the other, Doshi renders obvious this limitation. Ex.1003, ¶¶146-151.

9. Claim 6

[6.1] *The method of claim 4, wherein said overall cost function comprises a predefined entity cost metric.*

As discussed at [1.2]-[1.3] and [4.1], Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair and sums the path costs to find the cost of the pair together. The cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness—which represent the “*overall cost*” for each candidate path pair. The calculation used to determine the “*overall cost*” corresponds to the claimed “*overall cost function.*” Ex.1003, ¶¶152-153.

Each of these factors, considered in the cost calculation, is predefined in the sense that the cost calculation is pre-configured to consider each factor. For example, before a calculation is performed, it is understood that the calculation will consider link utilization, sharing degree, and path disjointedness. Additionally, the “utilization threshold” (e.g., nominally set to 80%) and “administrative weight” (e.g., a coefficient for scaling) are predefined metrics. Ex.1005, [0128], [0141]. Each of these metrics has an impact on the cost of the path being evaluated. Ex.1005, [0142]. Thus, each of link utilization, utilization threshold, administrative

weight, sharing degree, and disjointedness correspond to “*a predefined entity cost metric*.” Ex.1003, ¶154.

Additionally, traffic engineering metrics correspond to “*predefined entity cost metric*” in the ’821 patent. Ex.1001, 5:49-51. A POSITA would have understood that Doshi’s link utilization, utilization threshold, and administrative weight each correspond to traffic engineering data—it was well known that traffic engineering data includes such metrics. *See* Ex.1022 (using “administrative weights” to implement traffic engineering decisions.); Ex.1023 (setting an administrative weight with an “mpls traffic-eng administrative-weight” command, setting a bandwidth threshold level of reserved bandwidth with an “mpls traffic-eng flooding thresholds” command, and identifying traffic engineering output fields that include administrative weight, reservable bandwidth, and bandwidth thresholds.); Ex.1024 (Entitled “Multiple Metrics for Traffic Engineering with IS-IS and OSPF” describing the metrics “administrative weight” and “bandwidth available.”). Ex.1003, ¶155.

Doshi’s disclosure is in the context of “multi-protocol label switched (MPLS) traffic engineering,” which would have further confirmed a POSITA’s understanding that Doshi’s link utilization, utilization threshold, and administrative weight each correspond to traffic engineering metrics. Ex.1005, [0298], [0010], [0093], [0191], [0257]. Ex.1003, ¶¶152-157.

10. Claim 7

[7.1] *The method of claim 6, wherein said predefined entity cost metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).*

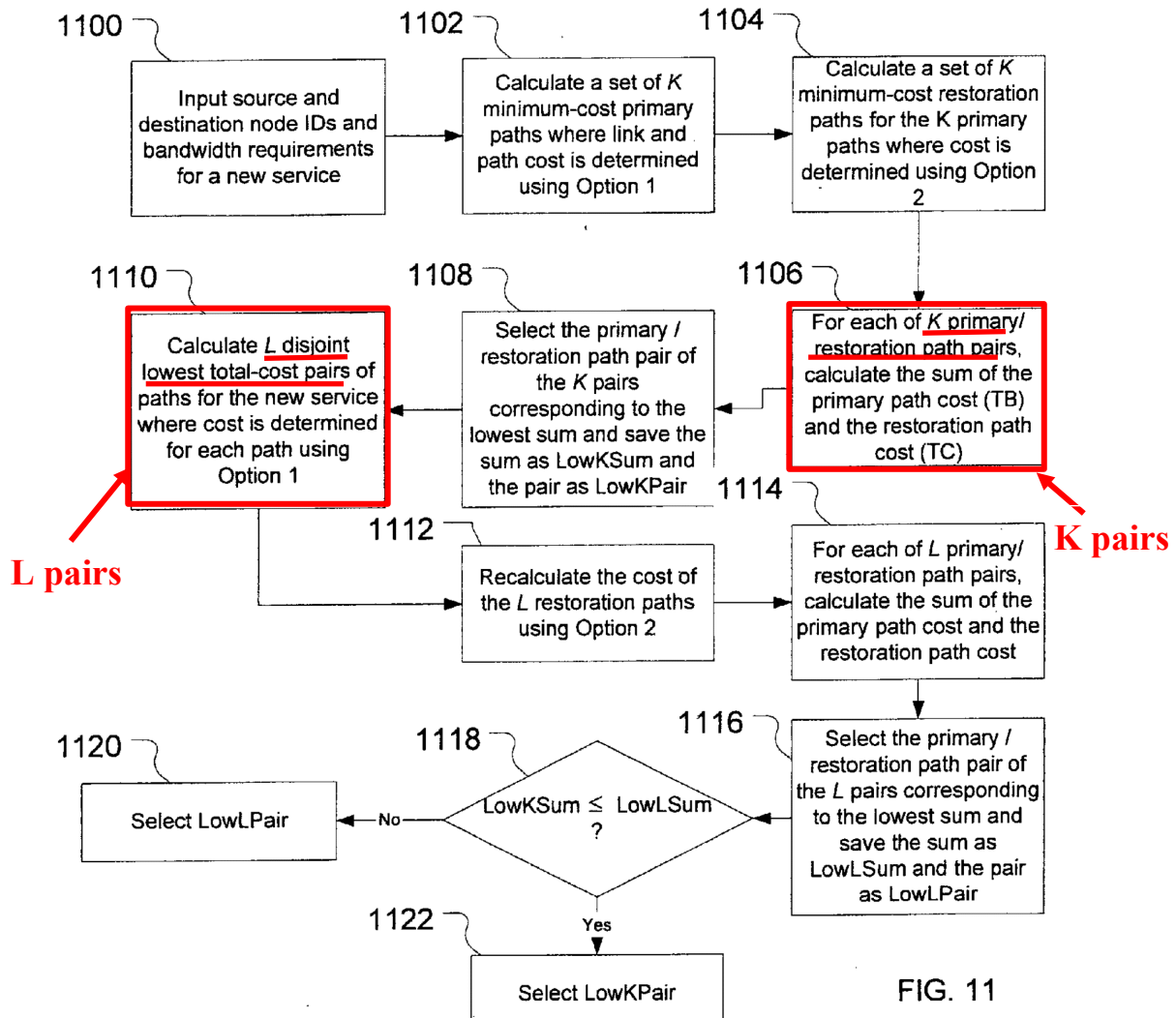
See claim 6. Ex.1003, ¶¶158-159.

11. Claim 9

[9.1] *The method of claim 4, wherein said overall cost function comprises: selecting a subset of entity pairs wherein each entity pair of said subset has substantially minimum probability of a concurrent failure of said protection entity and said working entity; and*

As discussed at [1.2]-[1.3], Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair and sums the path costs to find the cost of the pair together. The cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness, and which represent the “overall cost” for each candidate path pair. The calculation used to determine the “overall cost” corresponds to the claimed “overall cost function.” Ex.1003, ¶161.

As shown at Doshi’s Figure 11 and disclosed in the accompanying description, the cost calculation includes calculating and comparing two sets of candidate path pairs—“K candidate pairs” and “**L candidate pairs**,” where the L pairs are disjoint pairs. Ex.1005, [0142]-[0145]; Ex.1003, ¶162.



Ex.1005, Fig. 11 (annotated); Ex.1003, ¶162.

The L candidate pairs and K candidate pairs are both subsets of the total number of candidate pairs available. In the case of the L candidate pairs, the subset consists of pairs that are disjoint. As discussed at [5.1], the pairs include both a working path (e.g., working LSP) and a protection path (e.g., protection LSP) that are disjoint from each other, which substantially minimizes the probability of concurrent failure. Thus, Doshi's L candidate pairs correspond to “a subset of

entity pairs.” A POSITA would have understood selecting the set of L candidate pairs for calculations corresponds to “selecting” as claimed. Ex.1003, ¶¶160-165.

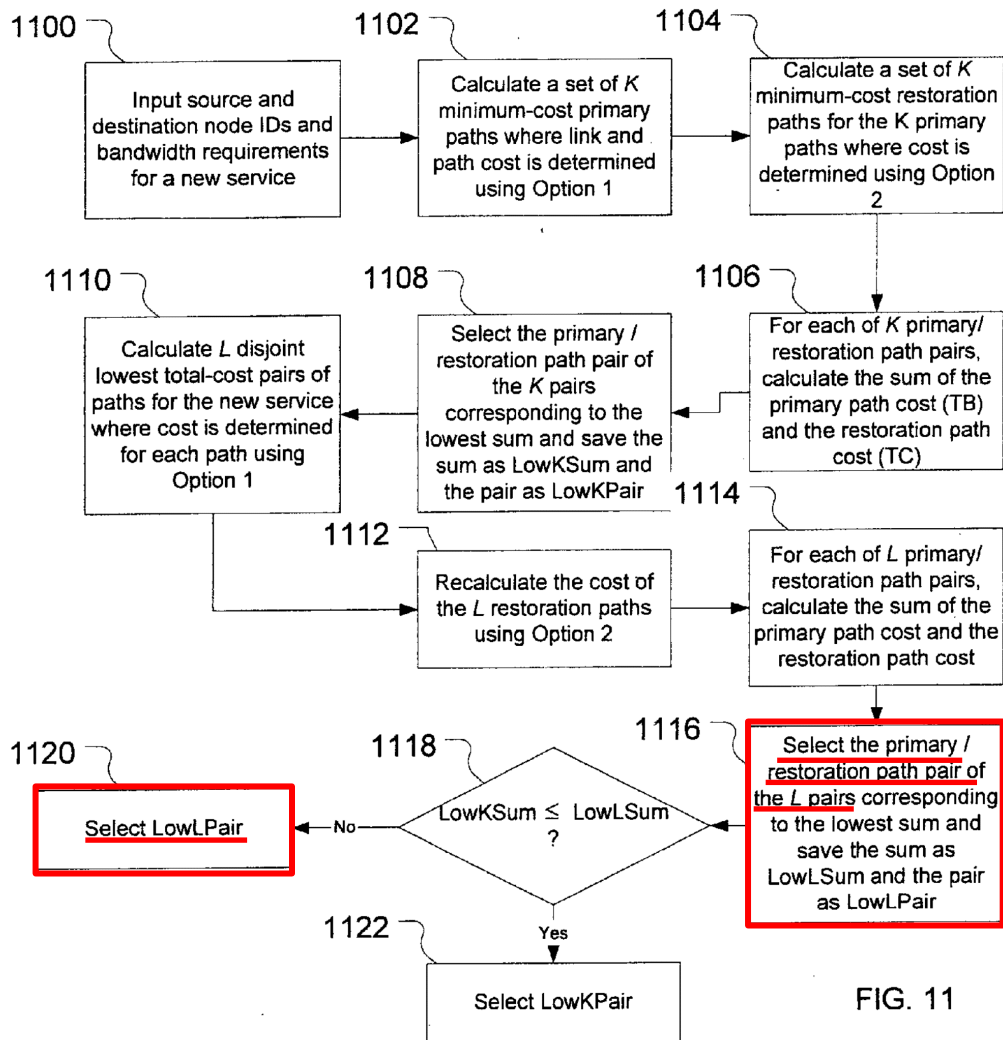


FIG. 11

Ex.1005, Fig. 11 (annotated); Ex.1003, ¶164.

[9.2] if said subset comprises at least two entity pairs, selecting an entity pair from said subset that minimizes an entity cost function.

As discussed at [9.1], Doshi calculates L “disjoint lowest total-cost pairs,” plural. Thus, Doshi’s L candidate pairs include at least two pairs. Doshi goes on to

explain that the L candidate pairs are assessed for cost, which as discussed at [1.2] includes assessing the cost of each path in the pair. As discussed at [1.2]-[1.3] and [4.1], Doshi calculates the path cost of each path (e.g., each primary and protection LSP) in a candidate path pair. The cost calculation considers various factors, including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness. Ex.1005, [0124]-[0141]. The calculation used to determine the path cost corresponds to the claimed “*entity cost function*.” Ex.1005, [0144]-[0145], Fig. 10 (element 1022 “Return PathCost”); Ex.1003, ¶166

Doshi describes selecting the lowest cost pair of the L candidate pairs as the lowest cost pair out of all pairs, including K candidate pairs. Ex.1005, [0142]-[0145]; Ex.1003, ¶167.

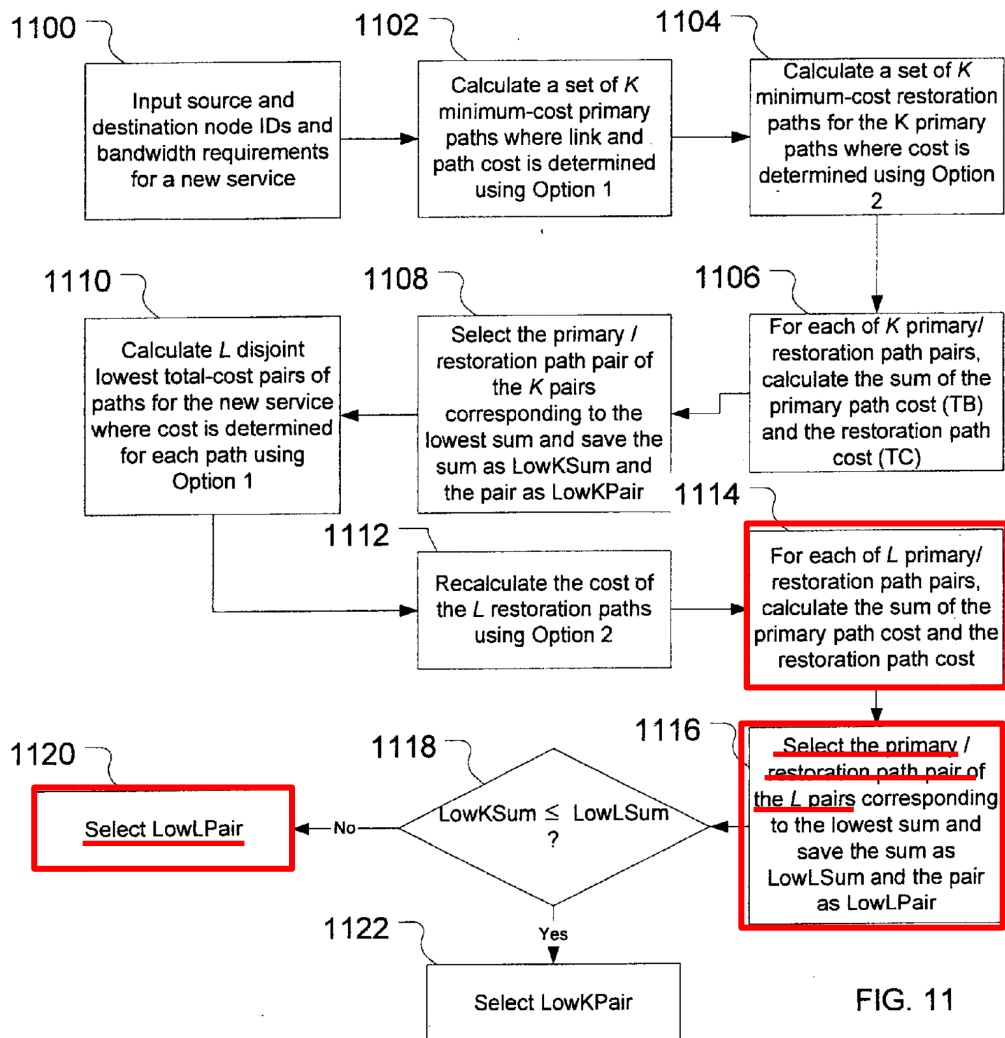


FIG. 11

Ex.1005, Fig. 11 (annotated); Ex.1003, ¶167.

Accordingly, it would have been obvious to a POSITA that selection of the lowest cost L pair—the lowest cost pair out of all the pairs—“*minimizes an entity cost function.*” Ex.1003, ¶¶ 166-169.

12. Claim 10

[10.1] *The method of claim 9, wherein said entity cost function comprises a predefined metric.*

As discussed at [9.2], Doshi’s cost calculation considers various factors,

including link utilization, utilization threshold, administrative weight, sharing degree, and disjointedness and corresponds to the claimed “*entity cost function*.” Further, as discussed at [6.1], these factors, along with traffic engineering, correspond to a “*predefined entity cost metric*,” which renders obvious “*a predefined metric*.” Ex.1003, ¶¶170-171.

13. Claim 11

[11.1] *The method of claim 10, wherein said predefined metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).*

See claim 10. Ex.1003, ¶¶172-173.

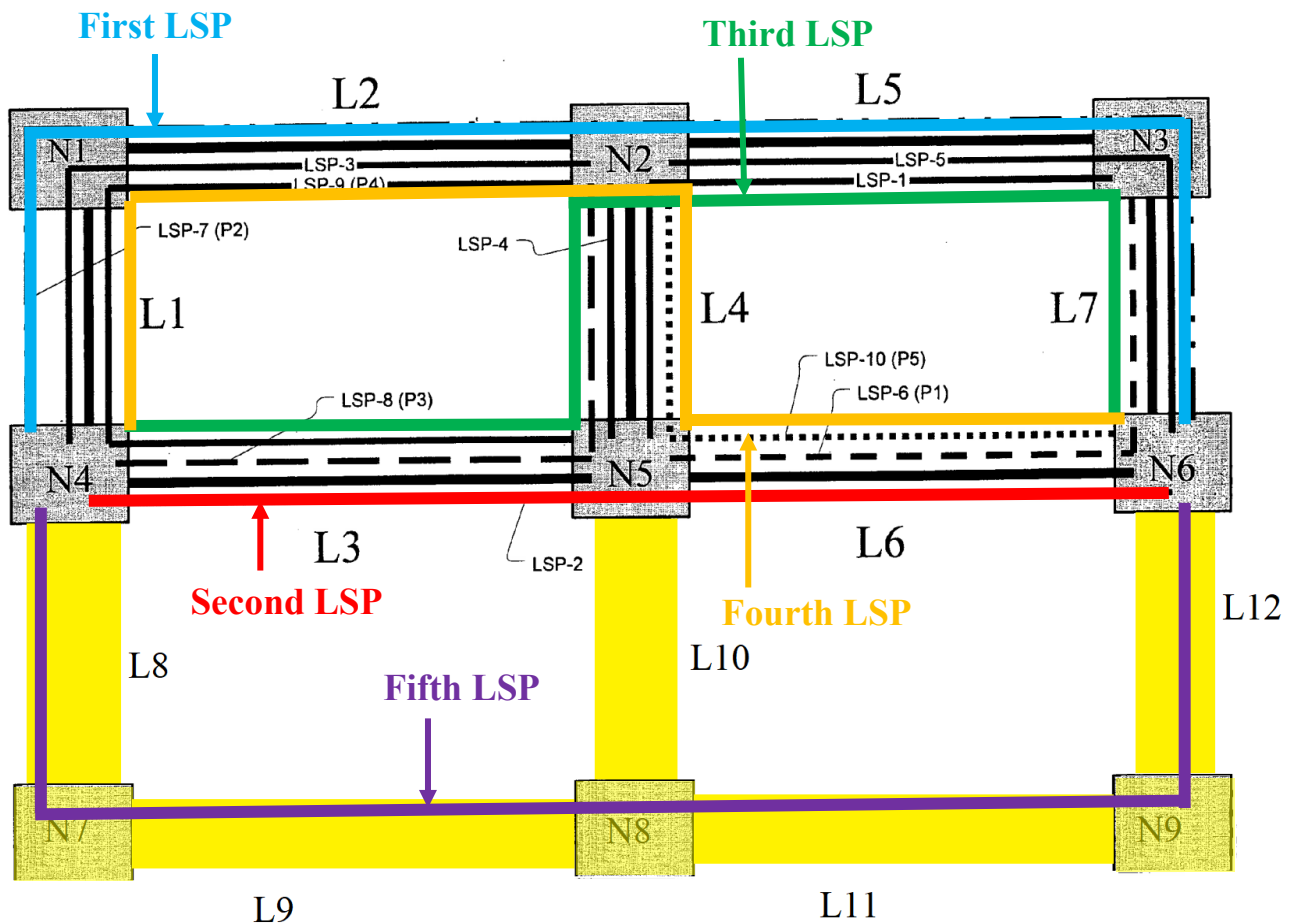
14. Claim 13

[13.1] *The method of claim 1, further comprising the step of: if said entity pair reselection results in both working and protection entities being replaced, sequentially replacing said working entity and said protection entity.*

Regarding replacement of the claimed “*working entity*” and “*protection entity*,” as discussed at [2.1] and [5.1], Doshi’s “primary path” is also referred to as a “working path” (e.g., working LSP), and its “restoration path” is also referred to as a “protection path” (e.g., protection LSP). Ex.1005, [0046]. Doshi’s primary path (aka working path) corresponds to the claimed “*working entity*” and Doshi’s restoration path (aka protection path) corresponds to the claimed “*protection entity*.” Ex.1003, ¶175.

As discussed at [1.3]-[1.4], Doshi teaches that a primary and a protection pair (e.g., LSP pair) are selected from the plurality of paths of the MPLS network and that, in view of Guichard's teaching of ongoing reoptimization efforts, it would have been an obvious to perform Doshi's cost calculations repeatedly to attempt to determine whether the originally selected LSP pair still has the overall minimum-cost or if another LSP pair should be selected. Ex.1003, ¶176.

It would have been obvious for the LSPs of the originally selected pair (e.g., a primary LSP and a protection LSP) to be sequentially replaced as the ongoing reoptimization efforts identify lower cost LSPs. To build upon an earlier example, consider Doshi's modified and annotated Figure 1 below. Ex.1003, ¶177.



Ex.1005, Fig. 1 (modified and annotated); Ex.1003, ¶177.

As previously discussed at [1.3]-[1.4], the Fifth LSP was selected as the primary path and the Second LSP was selected as the protection path. Upon an event trigger as taught by Guichard, attempted reoptimization of the LSPs would take place to determine if there is a better or more optimal LSP. If, for example, the reoptimization evaluation determined that the links of the Fifth LSP are heavily utilized as compared to the links of the First LSP, it would have been obvious for Doshi's cost determination to result in a new pair (e.g., the First LSP as the

primary while the Second LSP remains as the protection) as having the overall minimum cost. Thus, the Fifth LSP would be replaced. A subsequent such reoptimization evaluation would find that, for example, the Second LSP has become suboptimal as a protection path and replace the Second LSP with another LSP e.g., a newly added Sixth LSP (not shown)). Of course, this is just an example, and given network status it would be understood that other LSPs may be selected as the overall minimum cost pair, but the LSPs have been replaced sequentially in this example—first the primary LSP followed by the protection LSP. It would have been obvious for the sequence of replacement to be reversed in other examples where the protection LSP becomes suboptimal before the primary LSP. Ex.1003, ¶178

It would have been similarly obvious for a single event-triggered reoptimization evaluation to find that both the Fifth and Second LSPs are suboptimal. When both LSPs are determined to be suboptimal, a POSITA would have found it obvious to replace the LSPs sequentially to minimize interruption in service. In that regard, a POSITA would have appreciated the desirability of maintaining a working and protection path throughout the replacement process. In replacing the Fifth and Second LSPs with the First and Sixth LSPs, for example, a POSITA would have found it obvious to first designate the First LSP (determined to be the optimal primary LSP) as a new protection LSP temporarily, thereby

replacing the Second LSP. Next, traffic on the Fifth LSP would be switched over to the First LSP with the Fifth LSP temporarily serving as a protection LSP. The First LSP would thus become the new primary LSP as was determined to be optimal. The Fifth LSP, now acting as a protection LSP, would then be replaced by the Sixth LSP, which was determined to be the optimal protection LSP. A POSITA would have recognized that such sequential replacement would advantageously maintain two LSPs (e.g., one primary and one protection) throughout the replacement. Ex.1003, ¶¶174-180.

15. Claim 17

Claim 17 is substantially similar to claim 1 and therefore is obvious for the reasons stated above. The below analysis addresses the obviousness of the preamble's different recitations, to the extent limiting. Ex.1003, ¶182.

[17.0] *Non-transitory computer readable media configured to perform a method comprising the steps of:*

As discussed at [1.0], Doshi discloses that the claimed method steps are performed by a network manager, that may be a server or other computing device. It was common knowledge that computing devices, such as servers, would include a processor and memory. *See* Ex.1025 [0092], Fig.10 (describing “exemplary computer system 1000 that can be used as ... a server” where the computer system 1000 includes “one or more processors,” “a main memory,” “and may also include

a secondary memory”); *see also* Ex.1031; Ex.1032; Ex.1033. Indeed, Doshi expressly discloses storing, for example, protection information and information about path pairs which would have informed a POSITA that Doshi’s network manager includes a memory. Ex.1005, [0143]-[0144], [0196], [0214]; Ex.1003, ¶183.

It was also known for memory to be non-volatile and computer readable by the processor (“*[n]on-transitory computer readable media*”). *See* Ex.1016 (describing “computer-readable” hard disk drives and flash memory cards “provide nonvolatile storage of data, data structures, computer-executable instructions, and so forth.”); *see also* Ex.1017; Ex.1018; Ex.1025, [0092]; *see also* Ex.1003, ¶184.

Accordingly, a POSITA would have found it obvious for Doshi’s network manager to include a memory that corresponds to a “*non-transitory computer readable medium*.” As discussed above at [1.0]-[1.5], Doshi’s network manager performs the method steps. Since, as evidenced by the citations above, it was common knowledge to store executable instructions in memory, and since Doshi’s network manager performs the method steps, a POSITA would have considered it obvious to store instructions to perform each step of the method in the memory of Doshi’s network manager. Accordingly, a POSITA would have found it obvious for Doshi’s network manager to include “*[n]on-transitory computer readable media configured to perform a method*.” Ex.1003, ¶¶183-186.

[17.1]-[17.5]

See [1.1]-[1.5]. Ex.1003, ¶¶187-191.

16. Claim 18

[18.1] *The non-transitory computer readable media of claim 17, wherein said step of selecting an entity pair further comprises: selecting a working entity from said plurality of transport entities; selecting a protection entity from said plurality of transport entities; and*

As discussed above at [1.3], Doshi discloses selecting an LSP pair comprising a primary LSP and a protection LSP from the plurality of MPLS LSPs. Doshi's "primary path" corresponds to a "working path." Ex.1005, [0046]. Thus, Doshi's step of selecting an LSP pair comprises selecting a "working path" and a protection path from the MPLS LSPs, which renders obvious this limitation.

Ex.1003, ¶¶192-194.

[18.2] *selecting an active entity from the set consisting of said working entity and said protection entity.*

See claim 3. Ex.1003, ¶195.

17. Claim 19

[19.1] *The non-transitory readable media of claim 18, wherein said step of selecting an entity pair further comprises minimizing an overall cost function.*

See claim 4. Ex.1003, ¶¶196-197.

18. Claim 20

[20.1] *The non-transitory readable media of claim 19, wherein said overall cost function comprises: minimizing a probability of concurrent failure of said protection entity and said working entity; and*

See claim 5. Ex.1003, ¶¶198-199.

[20.2] *a predefined metric selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).*

See claims 6 and 7. Ex.1003, ¶200.

C. Ground 2: Claims 8 and 12 are obvious under 35 U.S.C. § 103(a) over Doshi in view of Guichard and Huang.

1. Summary of Huang

Like the '821 patent and Doshi, Huang describes LSP selection within an MPLS network. Ex.1007, [0004], [0032], [0035], [0040]. Huang's LSP selection is described in the context of "protection of connections formed through a mesh-type communication network." Ex.1007, [0001]. In Huang, a request is received to set up an LSP segment between a head end node and a tail end node, where the request further identifies a backup route to the tail end node. Ex.1007, [0016]. The backup routes are LSPs that "protect each of the working links" if failure occurs. Ex.1007, [0032]. Huang's "working links" are also LSPs. *See* Ex.1007, [0030]-[0031]. Huang further describes "revertive switching," where "the connection will be switched back from the backup LSP to the working link once the working link has cleared the failure that caused the switchover." Ex.1007, [0053]; Ex.1003, ¶¶201-202.

2. Reasons to Combine Doshi and Huang

A POSITA would have been motivated to combine the teachings of Doshi and Huang, as discussed below. Ex.1003, ¶203.

First, Doshi and Huang are analogous art to the '821 patent. For example, just like the '821 patent, both references generally pertain to MPLS networks. Ex.1001, 3:15-18, Abstract; Ex.1005, [0049]; Ex.1007, [0004]-[0007]. Additionally, both references address the problem of selecting a pair of MPLS paths from available paths. Ex.1001, 4:63-5:8; Ex.1005, [0014]; Ex.1007, [0004], [0032], [0035], [0040], [0048]. Thus, given the similarities between the references and the fact that they address the problem of selecting LSPs, a POSITA considering Doshi would have naturally considered the teachings of Huang. Ex.1003, ¶204.

Second, a POSITA would have been motivated to combine the teachings of Doshi and Huang to produce numerous predictable and beneficial results. Ex.1003, ¶205.

Doshi teaches “Switching Between Working and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Ex.1005, [0266]-[0267]. Huang complements Doshi by teaching what to do when the failure affecting the working LSP has been cleared. Huang teaches “revertive switching”

where “the connection will be switched back from the backup LSP to the working link once the working link has cleared the failure that caused the switchover.”

Ex.1007, [0053]; Ex.1003, ¶206.

A POSITA would have been motivated to configure Doshi’s working LSP as revertive, in view of Huang, to avoid the need to calculate and select a replacement working LSP, when the previously selected working LSP has been quickly restored. Reverting allows for the previously selected working LSP (which as discussed at [1.2]-[1.4] is part of the overall minimum-cost pair) to be utilized without any additional computations or selections. A POSITA would have recognized that in cases of quick restoration, e.g., when a mistaken failure diagnosis is quickly resolved, it would be simpler to revert back to the working LSP instead of having the network manager calculate the costs for all LSPs to ultimately reach the same result of selecting the working LSP. Thus, Huang’s teachings obviate unnecessary efforts. Ex.1003, ¶¶207-208.

The combination is merely the use of a known technique (Huang’s technique of configuring the working LSP as revertive) to improve a similar method (Doshi’s method for selecting working and protection LSPs) in the same way with predictable results (reverting back to Doshi’s working LSP once the failure has been cleared without performing needless calculations). Ex.1003, ¶209.

The results would have been predictable and there would have been a reasonable expectation of success in the combination. A POSITA would have had a reasonable expectation of success because Huang provides implementation details, such as waiting to revert back until the working LSP has been restored. Ex.1007, [0053]. Also, the expectation of success is evidenced by the fact that revertive switching was in described in multiple RFCs discussing MPLS operation. Ex.1011, 12; Ex.1030, 16; Ex.1003, ¶¶210-212.

Implementing the combination would have been within a POSITA's skillset since Doshi already sets forth techniques for switching between working and protection LSPs. Ex.1005, [0266]-[0268]. Building upon Doshi to configure working LSPs as revertive, per Huang, would utilize already existing switching techniques. Doshi acknowledges that a skilled artisan would have had the necessary skill set to make "[v]arious modifications of the described embodiments." Ex.1005, [300]. It would have been obvious for such modifications to include reverting back to the working LSP after a failure of the working LSP has been cleared. Ex.1003, ¶¶211-213.

3. Claim 8

[8.1] *The method of claim 4, further comprising the step of configuring said working entity as revertive.*

First, as discussed at [2.1], Doshi describes "Switching Between Working

and Protection LSPs” and explains that “after detecting a failure, end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.” Ex.1005, [0266]-[0267]. Doshi also incorporates by reference in its entirety RFC 3209 (Ex.1005, [0056]), which describes returning to an “original path when the failed resource becomes re-activated.” Ex.1011, 12. Since Doshi describes switching from a working LSP to a protection LSP after a failure, and since Doshi incorporates RFC 3209’s disclosure of returning to an original path that is re-activated after a failure, it would have been obvious to a POSITA to configure the working LSPs as revertive. Thus, Doshi renders obvious “*configuring said working entity as revertive.*” Ex.1003, ¶¶214-215.

Second, like RFC 3209, Huang also teaches “that, in the event of a failure” of a working link, traffic “may be switched to corresponding individual backup LSPs” (e.g., a “protection LSP” in terms of Doshi). Ex.1007, [0032]. The “working links” are LSPs. *See* Ex.1007, [0030]-[0031]; Ex.1003, ¶¶216-217. Huang also discloses “**revertive switching**,” such that the “the connection will be switched back from the **backup LSP to the working link** once the working link has cleared the failure that caused the switchover,” which corresponds to “*configuring said working entity as revertive.*” Ex.1007, [0053]; Ex.1003, ¶218.

A POSITA would have found it obvious to utilize revertive switching in Doshi, as taught by Huang, such that the switch configures the working LSP to be

used again once the fault is cleared. A POSITA would have recognized that in some instances, e.g., in the case of a quickly resolved mistaken failure diagnosis, it would be simpler to revert back to the working LSP instead of calculating the costs for all LSPs only to again select the working LSP. *See also* Reasons to Combine Doshi and Huang, § VIII.C.2. Ex.1003, ¶¶214-220.

4. Claim 12

[12.1] *The method of claim 10, further comprising the step of configuring said working entity as revertive.*

See claims 8 and 10. Ex.1003, ¶¶221-222.

D. Ground 3: Claims 14-16 are obvious under 35 U.S.C. § 103(a) over Doshi in view of Guichard and Xu.

1. Summary of Xu

Like the '821 patent and Doshi, Xu describes selecting paths to protect against failures in an MPLS network. Ex.1025, [0001], [0005]-[0006], [0030], [0035]-[0038], [0043]. Xu discloses “selecting the end-to-end paths” based on a “set of modeled failure states.” Ex.1025, [0006], [0043], [0049]. The states represent “link failures that occur simultaneously” with “a predetermined probability of occurrence.” Ex.1025, [0006]-[0007], [0049], [0053], [0080]; Ex.1003, ¶¶223-225.

2. Reasons to Combine Doshi and Xu

A POSITA would have been motivated to combine the teachings of Doshi and Xu, as discussed below. Ex.1003, ¶226

First, Doshi and Xu are analogous art to the '821 patent. Just like the '821 patent and Doshi, Xu generally describes MPLS networks. Ex.1001, 3:15-18, Abstract; Ex.1005, [0049]; Ex.1025, [0036], [0038]. Xu also addresses the problem of selecting paths within an MPLS network. Ex.1001, 4:63-5:8; Ex.1005, [0014]; Ex.1025, [0002], [0030], [0040], [0043], [0060]. Given the similarities between the references and their addressing the same problem of selecting paths, a POSITA considering Doshi would have naturally considered the teachings of Xu. Ex.1003, ¶227.

Second, a POSITA would have been motivated to combine the teachings of Doshi and Xu to produce numerous predictable and beneficial results. Ex.1003, ¶228.

Doshi teaches protecting services against link failures by considering disjointedness when selecting primary and protection paths. Ex.1005, [0155]-[0156]. Strictly disjoint paths share no common links or nodes other than their common ingress and egress nodes, so the failure of a single network element would not affect both paths. Ex.1005, [0055], [0158]. Doshi recognizes, however, that there “will be some cases ... where no strictly disjoint path exists” or where

“other factors...may lead to selection of a protection path, for a given primary path, that is not strictly disjoint from the primary path.” Ex.1025, [0055]. It would be obvious, in such instances, to at least minimize the likelihood of a concurrent failure. Xu complements Doshi by teaching that a probability of occurrence is determined for each of a set of failure states and that path selection decisions consider the probability of various failure states occurring. Ex.1025, [0006], [0053]; Ex.1003, ¶229.

A POSITA would have been motivated to determine a probability of occurrence of failure states, as taught by Xu, when implementing Doshi’s path selection in order to further inform selection decisions and better protect services against link failures in circumstances where no strictly disjoint pair of paths exists or where other factors lead to selection of a partially disjoint pair as discussed above. Determining the probability of various failure states would further refine selection between pairs of paths that have the same disjointedness (e.g., between pairs all having a primary path that shares one link in common with its protection path). Such pairs have the same disjointedness, but there may be differences in risk of failure for different links. A pair in which the link in common between primary and protection paths of the pair has a higher risk of failure would, everything else being equal, be more likely to concurrently fail than a pair in which the link in common has a lower risk of failure. A POSITA would have been motivated to

apply Xu's probability determination to differentiate between such pairs to improve reliability by reducing the probability of concurrent failure of Doshi's selected pair. Ex.1003, ¶230.

The combination is merely the use of a known technique (Xu's probability determination) to improve a similar method (Doshi's method for selecting paths) in the same way with predictable results—selecting paths with lower probability of failure. The results would have been predictable, and there would have been a reasonable expectation of success in the combination since Doshi and Xu are analogous art in the same field of endeavor. Ex.1003, ¶231.

Implementing the combination would have been within a POSITA's skillset because techniques for determining the probability of network failures were known in the art. *See* Ex.1026. Xu leaves implementation details of failure probability determination to a POSITA, recognizing that a POSITA would have had sufficient skills to configure the determination. Xu explains that “the present disclosure [is] not limited to any specific combination of hardware and software and the computer program code required to implement the foregoing can be developed by a person of ordinary skill in the art.” Ex.1025, [0094]-[0096]. Xu's techniques can be “practiced or carried out in a variety of applications.” Ex.1025, [0029]. Since Doshi is analogous art in the same field of endeavor, it would have been obvious to carry out Xu's probability determination in the context of Doshi's path selection

with a reasonable expectation of success. Indeed, Doshi acknowledges that a POSITA would have had the necessary skill set to make “[v]arious modifications of the described embodiments.” Ex.1005, [300]. It would have been obvious for such modifications to include Xu’s failure state probability determination. Ex.1003, ¶¶232-233.

3. Claim 14

[14.0] *A system for selecting entities within an MPLS network, comprising:*

As discussed at [1.0], Doshi discloses selecting LSPs within an MPLS network, which renders obvious “*selecting entities within an MPLS network.*” Doshi’s network components, e.g., network manager, nodes, modules, switches, etc., and corresponding communication paths, that are involved in the selecting correspond to the claimed “*system.*” See Ex.1005, [0014], [0035], [0081], [0214], [0271]; Ex.1003, ¶¶234-235.

[14.1] *a data structure comprising a plurality of transport entity descriptors;*

First, as discussed at [1.1], Doshi in combination with Guichard discloses providing a plurality of LSPs between two end nodes where the LSPs correspond to “*a plurality of [] transport entit[ies].*” Ex.1003, ¶236.

Second, as discussed at [1.2]-[1.5], Doshi in combination with Guichard discloses calculating the cost of various LSP pairs and selecting the lowest cost pair. A POSITA would have found it obvious to store and reference “*descriptors*”

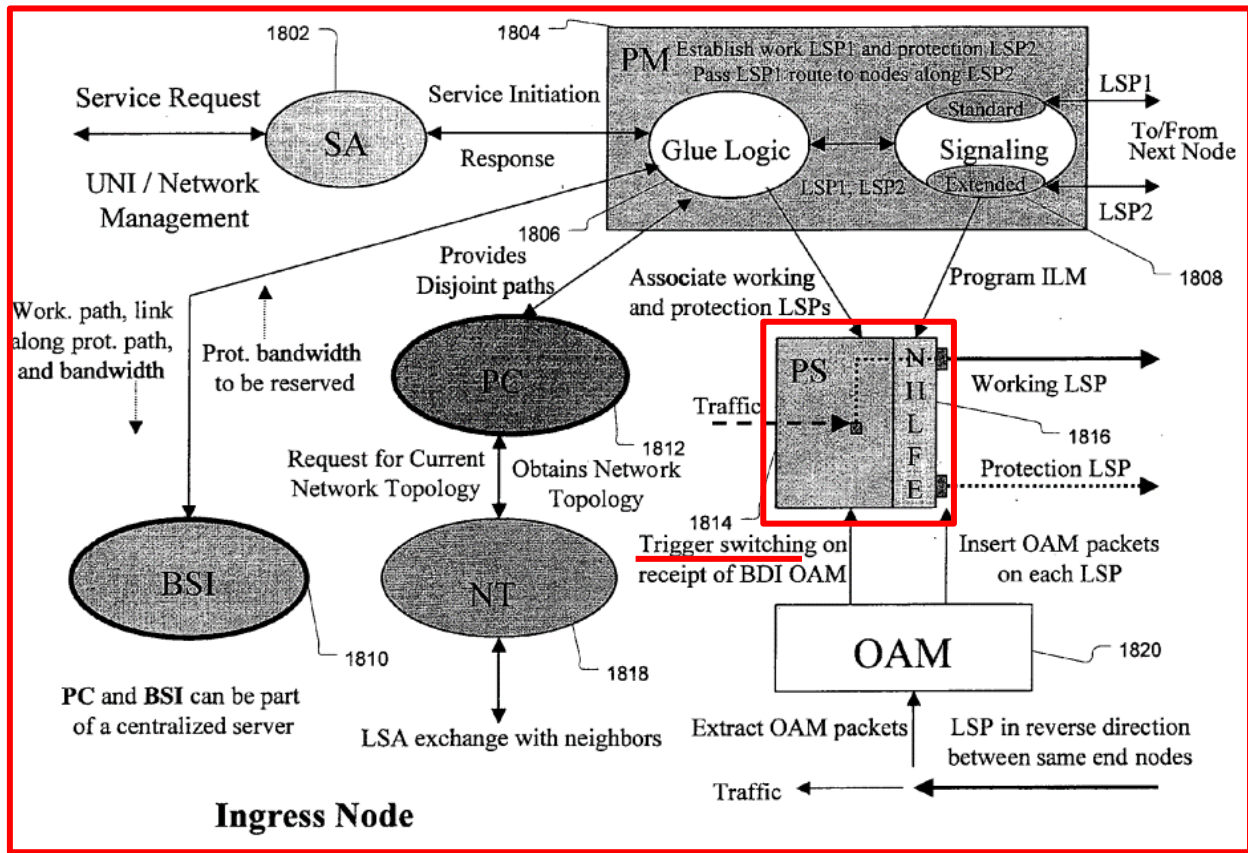
of the LSPs at least temporarily to accomplish the cost calculation and selection described above. Such storage would be in a memory, entries in which a POSITA would understand corresponds to a “*data structure*.” Ex.1003, ¶237

Moreover, Doshi expressly describes saving information about a plurality of LSP pairs in a data structure during cost calculation. Ex.1005, [0143] (“[T]he minimum-cost pair is saved in the **data structure** LowKPair.”); Ex.1005, [0144] (“[T]he lowest-cost pair is stored in the **data structure** LowLPair.”). Doshi also maintains “an extended link-state database” (referred to as “TE/Share database”) that include information used for “path computation.” Ex.1005, [0196]. “This database contains a **data structure** for each link L that the node owns. The data structure for each link contains information (e.g., bandwidth, link-id) about all the other links in the network for which link L provides restoration capacity.” Ex.1005, [0197]; *see also* Ex.1005, [0082], [0091]-[0095], [0172]-[0176]; Ex.1003, ¶¶238-239.

Doshi also describes a functional architecture that includes a “Path Management” module that is “responsible for path setup, refresh, tear-down, and monitoring functions.” Ex.1005, [0273]. It would have been obvious to a POSITA to store “*descriptors*” of the monitored paths in a “*data structure*” to differentiate the paths and to provide data entries for the paths such that changes can be tracked over time and saved in association with the relevant path. Ex.1003, ¶¶240-241.

[14.2] *an entity protection switch configured to switch between a working entity and a protection entity; and*

Doshi describes that “after detecting a failure, **end nodes of an LSP switch traffic from a primary (i.e., working) LSP to its corresponding protection LSP.**” Ex.1005, [0266]-[0267]; *see also* [0266] (“Switching Between Working and Protection LSPs”). Doshi further discloses a “**Protection Switching (PS)**” module that is “**responsible for switching the affected traffic onto a protection LSP** after detecting a failure or receiving failure notification.” Ex.1005, [0278]. Doshi’s exemplary Protection Switching module at Figure 18 illustrates its inclusion in a node of an LSP. Ex.1003, ¶242.



Ex.1005, Fig. 18 (annotated); Ex.1003, ¶242.

Thus, Doshi's node (including the Protection Switching module) or the Protection Switching module itself, which is configured to switch between the working LSP and the protection LSP, renders obvious this limitation. Ex.1003, ¶¶242-244.

[14.3] digital logic configured to select said working entity and said protection entity from said plurality of transport entity descriptors, comprising:

First, as discussed at [1.0]-[1.5] and [2.1], Doshi in combination with Guichard discloses logical flowcharts (e.g., at Figures 10 and 11) for selecting a working primary LSP ("working entity") and a protection LSP ("protection

entity”). As discussed at [14.1], a POSITA would have found it obvious to store and reference “*descriptors*” of the LSPs to accomplish cost calculation and selection of the LSPs. Accordingly, selection of a working LSP and a protection LSP from the descriptors renders obvious “*select[ing]*,” as claimed. Ex.1003, ¶245.

Second, a POSITA would have found it obvious to implement Doshi’s flowchart logic (e.g., at Figures 10 and 11) with software or a combination of software and hardware (“*digital logic*”) to perform the calculation and selection techniques. Doshi discloses a series of modules for performing its calculation and selection techniques. Ex.1005, [0270]-[0281]. A POSITA would have found it obvious to implement these modules in, for example, software or a combination of software and hardware (“*digital logic*”) since it was well known that such an implementation would allow for execution of instructions to control functionality (e.g., performing calculations and making decisions). *See* Ex.1016 (describing “computer-executable instructions for performing the methods of the disclosed innovation.”); Ex.1017 (describing “software and/or firmware provided in a read only memory ... for execution” by a processor “to implement the various functions as detailed below.”); Ex.1018 (describing using “software instructions to implement the present invention.”). Software or a combination of software and hardware that executes instructions, for example to carry out the flowchart of

Figures 10 and 11, to calculate and select the lowest cost pair corresponds to “*digital logic*,” as claimed. Ex.1003, ¶246.

A POSITA would have found it obvious to include such software or a combination of software and hardware, for example, in Doshi’s “network manager,” including the “Path Management” module that is “responsible for path setup, refresh, tear-down, and monitoring functions.” See Ex.1005, [0271]-[0273]; Ex.1003, ¶¶247-248.

[14.4] *logic configured to determine a probability of concurrent failure of said working entity and said protection entity;*

First, as discussed at [1.2], [2.1], [5.1], Doshi’s path calculation considers disjointedness of the working LSP (“*working entity*”) and the protection LSP (“*protection entity*”). Further, as discussed at [14.3], a POSITA would have found it obvious to use “*digital logic*” to perform Doshi’s flowchart logic, including path calculation and selection techniques. Ex.1003, ¶¶249-250.

Doshi recognizes that when two paths are disjoint, e.g., by being node- and link-disjoint, “then a failure affecting one of them will not affect the other.” Ex.1005, [0040]. A POSITA would have understood that probability of concurrent failure is inversely related to disjointedness—as paths become more disjoint, the likelihood they will fail concurrently goes down. Doshi recognizes that when two paths are disjoint, e.g., by being node- and link-disjoint, “then a failure affecting

one of them will not affect the other.” Ex.1005, [0040]. It would take two distinct failures (one affecting each path) for both paths to fail concurrently. Since Doshi explains that the “probability of occurrence” of two such failures is “**very insignificant**,” a POSITA would have understood that determining that two paths are disjoint with no nodes or links in common is also a determination that the paths have a “very insignificant” probability of failing concurrently. Ex.1005, [0040]. Accordingly, determining path disjointedness (as part of Doshi’s flowchart) corresponds to “*determine[ing] a probability of concurrent failure*” since knowledge of, e.g., strict disjointedness represents a determination that there is a “very insignificant” probability that the paths will fail at the same time. Ex.1003, ¶¶250-251.

Second, Xu discloses a “network architecture [that] uses multiple paths between each ingress-egress router pair” in an MPLS network and provides techniques for “selecting the end-to-end paths” between the pair by “Network-Management Software (NMS).” Ex.1025, [0030]-[0038]. To inform path selection, Xu models failure states that would cause at least one path to fail. Ex.1025, [0006], [0049], [0080], Claim 1, Claim 11. A POSITA would have understood that at least some of the modeled failure states would be states in which the failure affects two paths simultaneously—corresponding to a state of concurrent failure. Ex.1003, ¶¶252-253.

Xu explains that each failure state has a “predetermined probability of occurrence.” Ex.1025, [0006]. A POSITA would have understood that a “**predetermined**” probability has been “*determine[d]*.” When a failure state is one where the failure affects two paths simultaneously—a state of concurrent failure—Xu’s predetermining a probability of occurrence for that failure state corresponds to “*determin[ing] a probability of concurrent failure.*” Each failure state is assigned a weight in Xu’s selection function based on how common the state is (probability of occurrence). Ex.1025, [0010]; *see also* [0033], [0045], [0053], [0080]. Ex.1003, ¶254.

As discussed in more detail in VIII.D.2, a POSITA would have found it obvious determine the probability of occurrence of failure states, as taught by Xu, when implementing Doshi’s calculation and selection techniques and would have been motivated to determine the probability of various failure states to achieve a more refined selection between pairs of paths that have the same disjointedness. Ex.1003, ¶¶255-257.

[14.5] *logic configured to determine an entity cost of said plurality of transport entity descriptors: and*

First, as discussed at [1.2], Doshi’s calculates the cost for each LSP path of candidate LSP pairs. This is done for all candidate LSP pairs, which means that a cost is calculated for each LSP path. As discussed at [14.1], a POSITA would have

found it obvious to store and reference “*descriptors*” of the LSPs at least temporarily to accomplish cost calculation and selection of the LSPs. Further, as discussed at [14.3], a POSITA would have found it obvious to use “*digital logic*” to perform Doshi’s flowchart logic, including path calculation and selection techniques. Ex.1003, ¶¶258-260.

[14.6] *logic configured to reselect said working entity and said protection entity from said plurality of transport entity descriptors upon a reselection event,*

First, as discussed at [1.0]-[1.5] and [2.1], Doshi in combination with Guichard discloses reselecting an LSP pair from the plurality of MPLS LSPs in response to an event. The reselection includes reselecting a primary LSP and a protection LSP if they remain the lowest cost pair. Doshi’s “primary” LSP is also referred to as a “working path” (e.g., working LSP). Put differently, Doshi discloses reselecting a working LSP and a protection LSP. As discussed above at [2.1], these working and protection LSPs correspond to the claimed “*working entity*” and “*protection entity*,” respectively. As discussed at [14.1], a POSITA would have found it obvious to store and reference “*descriptors*” of the LSPs at least temporarily to accomplish cost calculation and selection of the LSPs. Further, as discussed at [14.3], a POSITA would have found it obvious to use “*digital logic*” to perform Doshi’s flowchart logic, including path calculation and selection techniques. Ex.1003, ¶¶261-263.

[14.7] wherein said reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.

See [1.5]. Ex.1003, ¶264.

4. Claim 15

[15.1] The system of claim 14, wherein said entity protection switch comprises a 1:1 switch.

As discussed at [14.2], Doshi discloses the claimed “entity protection switch.” Ex.1003, ¶¶265-267. Doshi further discloses that “[i]f the bandwidth were allocated in advance of a failure, this would correspond, in the parlance of the field of protection and restoration for optical transport networks, to a **1:1 protection scheme.**” Ex.1005, [0060]. Doshi’s protection switching module in the context of a 1:1 protection scheme renders obvious this limitation. Ex.1003, ¶¶265-268.

5. Claim 16

[16.1] The system of claim 14, wherein said entity protection switch comprises a 1+1 switch.

As discussed at [14.2], Doshi discloses the claimed “entity protection switch.” Ex.1003, ¶271. Doshi further discloses that “[i]f the bandwidth were not only allocated, but additionally if a copy of the service path's data were to be duplicated to the protection path, this would correspond to a **1+1 protection scheme.**” Ex.1005, [0060]. In some circumstances, “a **1+1 restoration scheme is**

the best option available for restoration” and therefore are “popular.” Ex.1005, [0147], [0178]. Doshi’s protection switching module in the context of a 1+1 protection scheme renders obvious this limitation. Ex.1003, ¶¶269-272.

IX. DISCRETIONARY DENIAL WOULD BE INAPPROPRIATE

A. Discretionary denial under the *Fintiv* factors is not appropriate

The six factors considered for § 314 denial strongly favor institution. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential).

1. No evidence regarding a stay

No motion to stay has been filed, so the Board should not infer the outcome of such a motion. *Sand Revolution II LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 at 7 (PTAB June 16, 2020) (informative); *see also Dish Network L.L.C. v. Broadband iTV, Inc.*, IPR2020-01359, Paper 15 (Feb. 12, 2021). Thus, this factor is neutral.

2. Parallel proceeding trial date

This factor weighs strongly against discretionary denial because the projected trial date—based on median time-to-trial statistics—is in August of 2024,

after the Board’s Final Written Decision is expected in July of 2024.³ While trial is currently scheduled for March 4, 2024 (Ex.1014), the Board recognizes “that scheduled trial dates are unreliable and often change.” *See* Director’s June 21, 2022 Memorandum on Discretionary Denials (“Memo”), 8. “The PTAB will weigh this factor [factor 2] against exercising discretion to deny institution under *Fintiv* if the median time-to-trial is around the same time or after the projected statutory deadline for the PTAB’s final written decision.” Memo, 9.

The co-pending district court case was filed in the Eastern District of Texas on July 22, 2022. *See* Ex.1012. The most recent statistics show a median time-to-trial in the Eastern District of Texas at 24.5 months. Ex.1013, 5. Accordingly, the projected trial date for purposes of *Fintiv* is August of 2024—approximately 24 months after July 2022, and after the Board’s Final Written Decision is expected in July of 2024. Because the projected trial date is “around the same time or after” the Board’s expected final written decision, this factor weighs in favor of institution.

3. Investment in the parallel proceeding

The co-pending litigation is in its very early stages, and the investment in it has been minimal. The parties have not exchanged preliminary positions on claim

³ July 2024 is 18 months after January 2023, when Petitioner expects a notice of accorded filing date for this petition.

construction or invalidity, expert discovery has not begun, and the parties have not exchanged their first set of discovery requests. *See PEAG LLC v. Varta Microbattery GmbH*, IPR2020-01214, Paper 8, 17 (Jan. 6, 2021). Further, the Markman hearing is not scheduled until September of 2023, two months after an expected institution decision by the Board. Ex.1014, 3.

Moreover, Petitioner only learned which claims were being asserted on November 3, 2022. *See* Ex.1015. Under *Fintiv*, Petitioner’s prompt filing “weigh[s] against exercising the authority to deny institution.” *Fintiv*, Paper 11 at 11 (“If the evidence shows that the petitioner filed the petition expeditiously, such as promptly after becoming aware of the claims being asserted, this fact has weighed against exercising the authority to deny institution under NHK”). This factor favors institution.

4. Overlapping issues with the parallel proceeding

There is no present overlap of prior art issues due to the early stage of district court litigation. For example, Petitioner has not served its preliminary invalidity contentions in the district court proceeding. Consequently, this factor favors institution.

5. Identity of parties

Petitioner is a defendant in the litigation. That is true of most Petitioners in IPR proceedings. Accordingly, this factor should not be a basis for denying institution.

6. Other circumstances

As discussed in detail above, the prior art presented in this Petition renders the Challenged Claims unpatentable as obvious. The merits of Petitioner's arguments are strong, and this factor weighs against discretionary denial. Memo, 4.

As such, because the *Fintiv* factors are either neutral or weigh against discretionary denial, and institution should not be denied on discretionary factors.

B. Discretionary denial under 35 U.S.C. § 325(d) is not appropriate

None of the references presented in the petition were cited or considered by the Examiner during prosecution of the '821 patent. Accordingly, discretionary denial under 35 U.S.C. § 325(d) is not appropriate.

C. Discretionary denial under *General Plastic* is not appropriate

The '821 patent has not been challenged in any prior IPR petition, so none of *General Plastic* discretionary institution factors apply to this Petition. *See General Plastic Indus. Co., Ltd. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 at 16 (PTAB Sept. 6, 2016) (Section II.B.4.i. precedential).

X. CONCLUSION

Accordingly, Petitioner has established a reasonable likelihood that the Challenged Claims are unpatentable.

Respectfully submitted,

Dated: January 9, 2023
HAYNES AND BOONE, LLP
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Theodore M. Foster
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Registration No. 57,456

XI. MANDATORY NOTICES

A. Real Party-in-Interest

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioner certifies that the real party-in-interest is Cisco Systems, Inc.

B. Related Matters

Pursuant to 37 C.F.R. § 42.8(b)(2), to the best knowledge of the Petitioner, the '821 patent is or was involved in the following case:

Case Heading	Number	Court	Date
<i>Orckit Corporation v. Cisco Systems, Inc.</i>	2-22-cv-00276	EDTX	Jul. 7, 2022

C. Lead and Back-up Counsel and Service Information

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Please address all correspondence to lead and back-up counsel. Petitioner consents to service in this proceeding by email at the addresses above.

XII. CLAIMS APPENDIX

- [1.0] 1. An entity selection method performed by a network device, comprising the steps of:
- [1.1] providing a plurality of multi protocol label switching (MPLS) transport entities between a first endpoint and a second endpoint;
- [1.2] determining an overall cost for each entity pair of said plurality of entities;
- [1.3] selecting an entity pair from said plurality of transport entities based at least in part upon said overall cost; and
- [1.4] if an entity pair reselection event occurs, reselecting said entity pair from the group consisting of said entity pair and a replacement entity pair comprising at least one entity distinct from the entities of said entity pair,
- [1.5] wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.
- [2.1] 2. The method of claim 1, wherein said step of selecting an entity pair further comprises: selecting a working entity from said entity pair; and selecting a protection entity from said entity pair.
- [3.1] 3. The method of claim 2, further comprising the step of selecting an active

entity from the set consisting of said working entity and said protection entity.

[4.1] 4. The method of claim 2, wherein selecting an entity pair further comprises minimizing an overall cost function.

[5.1] 5. The method of claim 4, wherein said overall cost function comprises substantially minimizing a probability of concurrent failure of said protection entity and said working entity.

[6.1] 6. The method of claim 4, wherein said overall cost function comprises a predefined entity cost metric.

[7.1] 7. The method of claim 6, wherein said predefined entity cost metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).

[8.1] 8. The method of claim 4, further comprising the step of configuring said working entity as revertive.

[9.1] 9. The method of claim 4, wherein said overall cost function comprises: selecting a subset of entity pairs wherein each entity pair of said subset has substantially minimum probability of a concurrent failure of said protection entity and said working entity; and

[9.2] if said subset comprises at least two entity pairs, selecting an entity pair from said subset that minimizes an entity cost function.

[10.1] 10. The method of claim 9, wherein said entity cost function comprises a predefined metric.

[11.1] 11. The method of claim 10, wherein said predefined metric is selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).

[12.1] 12. The method of claim 10, further comprising the step of configuring said working entity as revertive.

[13.1] 13. The method of claim 1, further comprising the step of: if said entity pair reselection results in both working and protection entities being replaced, sequentially replacing said working entity and said protection entity.

[14.0] 14. A system for selecting entities within an MPLS network, comprising:

[14.1] a data structure comprising a plurality of transport entity descriptors;

[14.2] an entity protection switch configured to switch between a working entity and a protection entity; and

[14.3] digital logic configured to select said working entity and said protection entity from said plurality of transport entity descriptors, comprising:

[14.4] logic configured to determine a probability of concurrent failure of said working entity and said protection entity;

[14.5] logic configured to determine an entity cost of said plurality of transport entity descriptors: and

[14.6] logic configured to reselect said working entity and said protection entity
from said plurality of transport entity descriptors upon a reselection event,

[14.7] wherein said reselection event is selected from a group consisting of adding
an entity to said plurality of transport entities, removing an entity from said
plurality of transport entities, an operational status change for one of said
plurality of transport entities, and a change in overall cost for one of said
plurality of transport entities.

[15.1] 15. The system of claim 14, wherein said entity protection switch comprises
a 1:1 switch.

[16.1] 16. The system of claim 14, wherein said entity protection switch comprises
a 1+1 switch.

[17.0] 17. Non-transitory computer readable media configured to perform a method
comprising the steps of:

[17.1] providing a plurality of MPLS transport entities between a first endpoint and
a second endpoint;

[17.2] determining an overall cost for each entity pair of said plurality of entities;

[17.3] selecting an entity pair from said plurality of transport entities based at least
in part upon said overall cost; and

[17.4] if an entity pair reselection event occurs, reselecting said entity pair from the
group consisting of said entity pair and a replacement entity pair comprising

- at least one entity distinct from the entities of said entity pair,
- [17.5] wherein said entity pair reselection event is selected from a group consisting of adding an entity to said plurality of transport entities, removing an entity from said plurality of transport entities, an operational status change for one of said plurality of transport entities, and a change in overall cost for one of said plurality of transport entities.
- [18.1] 18. The non-transitory computer readable media of claim 17, wherein said step of selecting an entity pair further comprises: selecting a working entity from said plurality of transport entities; and selecting a protection entity from said plurality of transport entities; and
- [18.2] selecting an active entity from the set consisting of said working entity and said protection entity.
- [19.1] 19. The non-transitory readable media of claim 18, wherein said step of selecting an entity pair further comprises minimizing an overall cost function.
- [20.1] 20. The non-transitory readable media of claim 19, wherein said overall cost function comprises: minimizing a probability of concurrent failure of said protection entity and said working entity; and
- [20.2] a predefined metric selected from the group consisting of interior gateway protocol (IGP) and traffic engineering (TE).

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), Petitioner hereby certifies, in accordance with and in reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,961.

Pursuant to 37 C.F.R. § 42.24(d), this word count excludes the table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing.

Dated: January 9, 2023

/Theodore M. Foster/
Theodore M. Foster
Lead Counsel for Petitioner
Registration No. 57,456

CERTIFICATE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. § 42.6(e) and 37 C.F.R. § 42.105, service was made on Patent Owner as detailed below.

Date of service January 9, 2023

Manner of service PRIORITY EXPRESS MAIL

Documents served Petition for *Inter Partes* Review Under 35 U.S.C. § 312 and 37 C.F.R. § 42.104 of U.S. 8,830,821; Petitioner's Exhibit List; All Exhibits; Petitioner's Power of Attorney.

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